"Explaining Subcontracting Practices in China's Construction Industry: Application of Transaction Cost Theory"

by

Shi Chen

"This thesis is submitted in partial fulfilment of the requirements for the degree of Master of Science in Built Environment from the University of London"

Bartlett School of Graduate Studies

University College London

September 2006

ProQuest LLC
789 East Eisenhower Parkway
P.O. Box 1346
Ann Arbor, MI 48106-1346

This report is submitted to the faculty of The Built Environment as part of the requirements for the award of the MSc Degree in Construction Economics and Management at University College London. It is substantially the result of my own work and that ideas, data and images, as well as direct quotations, drawn from elsewhere are identified and referenced.

TABLE OF CONTENTS Page

LIST OF TABLES Page

Chapter 2.

Chapter 3.

Chapter 4.

Chapter 5.

Chapter 6.

Appendix 1.

Appendix 2.

Appendix 4.

LIST OF FIGURES Page

Chapter 2.

Chapter 3.

Chapter 4.

Chapter 5.

Chapter 6.

Appendix 3.

Appendix 4.

Appendix 5.

ABBREVIATIONS LIST

BCEG	***Beijing Construction Engineering Group***
CCEED	***China Construction Eighth Engineering Division***
CCSEB	***China Construction Sixth Engineering Bureau***
CI	***Construction Industry***
CM	***Construction Management***
CSCEC	***China State Construction Engineering Corporation***
KBS	***Knowledge-based System***
MPH	***Ministry of Public Heath***
PM	***Project Management***
QM	***Quality Management***
RCT	***Rural Construction Teams***
SCG	***Shanghai Construction Group***
SOE(s)	***State-Owned Enterprise(s)***
SUCG	***Shanghai Urban Construction Group***
SVES	***Subcontracting Variable Evaluation System***
TC(s)	***Transaction Cost(s)***
TCA	***Transaction Cost Analysis***
TCE	***Transaction Cost Economics***
TCT	***Transaction Cost Theory***
UCO	***Urban Collective-Owned***
VA	***Value Added***
VI	***Vertical Integration***

ACKNOWLEDGEMENTS

This paper is based on a dissertation in partial fulfilment of an MSc degree with Honours in Construction Economics and Management at the Faculty of the Built Environment of Bartlett School at University College London (UCL).

First of all, my special thanks go to my report supervisor Dr. Chen-yu Chang at the Bartlett School of UCL. I benefited greatly from the help and guidance of him, who not only offered me the first glimpse of a theoretical mind in action, but also kindly provided me with continuing support in the content and form of the research, read the draft of this report and gave valuable comments as well.

I should also like to thank my many teachers who gave me many helps during my study at Department of Construction and Project Management of UCL. I am grateful for helpful ideas offered by Hedley and Stephen, who provided me support and encouragement when I was in my hard time. Also thanks John, my CM08 course director, who gave me great valuable suggestions of term paper and pointed out some important aspects that should be paid attention on my final report.

Moreover, I am indebted to my schoolmates, especially Akira Takuma, who gave me some valuable advice at the beginning of my research. Finally, my personal thanks are extended to my family and friends for their endless support and love.

ABSTRACT

During the last decades, the make-or-buy decision is being given more consideration within organisations because of its strategic implications. Subcontract decision-making is one of the key issues deriving from it. This paper develops empirical tests of nine hypotheses about make-or-buy decision in China's construction industry (CI) based on a thorough literature review of transaction cost theory, explains the subcontract's decision under what set of factors will drive managerial choice, especially which are the main influencing factors push a construction firm toward make-or-buy decisions. Moreover, it is concerned with evaluating the decision making variables for main contractor's consideration of subcontracting practice in China's CI, how it is likely to be happened and what the implications might be for the industry's clients and main contractors. Finally, an assessment model of subcontracting decision making factors is proposed. These empirical hypotheses of China's subcontracting practices have not been formally tested before and are supported by a series of interviews with experienced contractors, managers and professionals of China's CI. It is also believed that this will be amongst the first cross-sectional empirical observations of transaction cost make-or-buy theory using the data from China's CI.

Key words: Make-or-buy decision;
Subcontract;
Construction industry;
Transaction cost.

Word Count: 10,916 (excluding tables and charts)

Chapter 1. Introduction

1.1 Background of the Research

Over the last number of years, the make-or-buy decision has become an important issue for many organisations. It can often be a major determinant of profitability making a significant contribution to the financial health of a company (Yoon, and Naadimuthu, 1994). Therefore, the decision to make-or-buy has a rich and varied literature reflecting its importance and interest to both scholars and practitioners, and has been widely applied to many areas, such as Manufacturing Industry (Buchowicz, 1991; Padillo and Meyersdorf, 1996; Probert, 1996; Veugelers and Cassiman, 1999; Frederix, 2001; Tayles and Drury, 2001; Mantel; Tatikonda and Liao, 2005; etc.), Information System (Ang and Cummings, 1997; Ngwenyama and Bryson, 1999; Goldsby and Eckert, 2003; Mayer and Argyres, 2004), Technological Industry (Lacity and Willcocks, 1998; Leiblein; Reuer and Dalsace, 2002), Aerospace Industry (Masten, 1984; Lefebvre and Lefebvre, 1998; Amesse et al, 2001), Electric Utility Industry (Jensen and Rothwell, 1998), Automobile Industry (Monteverde and David, 1982; Walker and Weber, 1984; Veloso and Fixson, 2001; Bigelow, 2004), Telecommunication (Beard; Ford and Koutsky, 2005), Military Companies (Fredland, 2004), Export Trade (Peng; Zhou and York, 2006), Hospital Industry (Hodgkin; Horgan and Garnick, 1997; Coles and Hesterly, 1998a, 1998b) or Pharmaceutical Manufacture (White, 2000), and so on. Obviously, looking through this literature, econometric studies assign a prominent role to make-or-buy decision in various industries. Construction is one industry where subcontracting is used extensively. Surprisingly, few studies have applied it to subcontracting practice of construction industry (CI). Only González-Díaz; Arruñada and Fernández's (2000) work analyses factors determining the degree of subcontracting, using evidence from the CI which based on contractual theories, although some arguments are close to the resources and capabilities theory.

Historically, construction has played a leading role in the economic development of the nation state (Debrah and Ofori, 2001). Facing a competitive and dynamic business environment, the large size and the complexity of construction projects usually drive construction firms to operate as general contractors taking on subcontractors to carry out specific project activities, this is called subcontracting. As early as 1980s, Eccles (1981) had pointed out an organisational form—'quasifirm', which based on a set of stable relationships between a general contractor and special trade subcontractors, is analogous to the inside contracting system in manufacturing. Subcontracting the constituent parts of the building process to specialist organisations can be one of the most efficient ways of carrying out building works (Franks, 1984). Today, subcontracting is a widespread practice in modern construction management (CM) all over the world. To date, much study of subcontracting is focusing on how to select a qualified subcontractor, but ignore the influencing factors of making whether subcontract or non-subcontract decisions in terms of different types of construction activities.

The production of any good or service usually requires a fairly wide range of activities, and there is no exception for construction. During the 1990s, "outsourcing[1]" (represents the "buy" alternative) has grown rapidly (Vining and Globerman, 1999). It includes a number of key strands which related to value chain[2] perspective, core competency thinking and supply base influences. There is evidence, however, to suggest that organisations are not always achieving the desired benefits from "sourcing in-house" (insourcing or vertical integration, represents the "make" alternative) or "outsourcing" (McIvor, et al.1997; McIvor, 2000). A fundamental question to ask is whether outsourcing is value enhancing and, in particular, increases profitability of the firm engaging in the outsourcing strategy (Görg and Hanley, 2004).

[1] Traditionally, outsourcing is an abbreviation for "outside resource using". Arnold (2000) analysed all the three parts of this. If you want to see the details, please refer to *Appendix 6-Terminology*.

[2] A value chain is the process that begins with the acquisition of raw materials and ends with the distribution and sale of finished goods (Besanko, et al. 2004).

In fact, many scholars have cognised that outsourcing decisions are made most frequently by default on the basis of saving most on overhead costs, with little consideration for the long-term competitiveness of the organisation (Blaxill and Hout, 1991; Lonsdale and Cox, 1997; McIvor, 2000; Buehler and Haucap, 2004). Since the same circumstance also exists in CI, one of the key issues to emerge in subcontracting practices has been the growing importance of the make-or-buy decision. Moreover, the make-or-buy decisions of subcontracting in CI have the problems that they are made most frequently by main contractors' subjective opinions, with little consideration for the profits and long-term operation of the construction companies, especially in China's CI due to its developing situation. Actually, the decision making of subcontracting is a very complex issue in CI. Main contractors need to consider many aspects, such as the situation and opportunity of the market, macro-economic issues, company management and growth, cash flow difficulties, quality control, allocation of capital, roundly inspecting the potential partnering enterprise, technical capability of the supplier, and negotiating strength of potential suppliers, and so on. Transaction cost economics[3] (TCE) has sought to place these concerns[4] within an economic context and relate the outcome of individual make-or-buy decisions to details of the transaction (Masten, 1984).

1.2 Research Objectives and Key Questions

In recent decades, due to the main contractors' wish to spread risk, 'over 90 percent of construction activity is now sub-contracted on the majority of contracts' (Burnett, 1991), and it has an increasingly important role in developed countries. Differently from this, according to the "Construction Law" and "Tendering and Bidding Law" of China, the subcontracted work cannot be more than 30% of the total construction

[3] Transaction cost economics (TCE) is an empirically supported, theoretical paradigm that has been used to understand and predict the outcomes of make-or-buy decisions (McNally and Griffin, 2004). TCE's main hypothesis was empirically supported: specificity (measured by lock-in) and incomplete contracts (measured by the transaction's complexity) lead to vertical integration (Tadelis, 2002).

[4] Williamson describes TCE as "an interdisciplinary undertaking that joins economics with aspects of organizational theory and overlaps extensively with contract law" (Williamson, 1979).

project. Therefore, in the process of making subcontract or non-subcontract decisions, how to select efficient subcontract based on variables seems to be very important for minimising the expected cost and finishing a successful project under the limited subcontracting capacity at the situation of China.

Subcontracting decision is a complex issue, which can impact upon expected cost, profitability, the quality of a project, and so on. It is, therefore, the most important issue in construction project management (PM). Moreover, the decision of whether or not subcontracting different types of activities in a project is the prerequisite of a successful subcontract management. Furthermore, it is also the problem of how do firms set or design their boundaries, and what determines the vertical structure of a firm's value chain. Hence, the decision to non-subcontract (make) a type of construction work, product or process internally, or to contract out, purchase the relevant technology and labour (buy) is one facing many construction companies and main contractors in CI. One objective of this work was to explain the subcontract's decision under what set of factors will drive managerial choice, especially which are the main influencing factors push a construction firm toward make-or-buy decisions. Since the literature offers some clues as to how make-or-buy decisions are actually made, this study based on a class of hypothesises according to the TCE theory, will focus on the key factors leading to subcontracting in China's CI and illustrate whether subcontracting or not should be carried out from a TCE perspective and integrated into the previous studies of the make-or-buy decision, vertical integration (VI), and relationship, etc. which are associated with organisations' strategic views. With these objectives in mind, we will investigate the following key questions by interviews and personal contacts with some main contractors who have or have had direct experience for subcontracting practices in China.

The key questions of this research are as follows:

- What types of work have been outsourced or kept in-house in subcontracting practice in China's CI, why?

- What factors would influence the decision about subcontract or non-subcontract?
- Give suggestion on how to make subcontract or non-subcontract decisions in China's CI.

Besides these, the survey also indicated other factors of concern to main contractors in deciding whether to subcontract or not, such as the cross-culture issues and 'Guanxi' (relationship) concept in China.

My findings will develop contractors, government and academic researchers. Examples of the benefits realised include the minimisation of expected cost for projects, improvements in constructional efficiency and productivity, gained economic benefit for the construction firms, and improved supply chain co-ordination. Furthermore, main contractors or clients will recognise the way to subcontracting activities by making a correct make-or-buy decision. This can not only make more profits for the construction firms, but also make sense for the government to implement the Construction Law. Besides highlighting the information of key factors that may affect the make-or-buy decision making of main contractors by applying TCT, the results of my research will also provide researchers in the construction business with information on relationships between main contractors and subcontractors in China[5].

This will be in the benefit of other countries' international contractors or subcontractors entering China's CI, and will also benefit the government as a large construction client with have better practice in subcontracting as well. All the above, will improve the practices and effectiveness of subcontracting in China's CI, and move the Chinese construction market towards international methods.

[5] For all the clients and main contractors, there will be the provision of how to make subcontracting decisions and minimise expected cost in vertical integration. For subcontractors, knowledge of how to keep the relationships with their clients or main contractors or gain better project partnership shall be furthered.

1.3 Structure of the Thesis

The paper is structured as follows. In the next section, a brief overview of China's CI will be introduced followed by an extensive critical literature review of the theories of the TCE and make-or-buy decision in Chapter 3. A detailed description of the methodology of this research and the preparation for interviews will be contained in Chapter 4. Chapter 5 and Chapter 6 then, respectively, try to formulate nine hypothesises of the key factors affecting subcontracting decisions in China's CI, and they will be tested in a sample of five Chinese state-owned construction firms' behaviour and interviews by analysing the collected data with some statistical methods. Before making the summary and conclusions, I will present the limitations of this study in Chapter 7. Finally, concluding remarks and the implications for further research are offered in Chapter 8.

Chapter 2. Construction Industry in China

2.1 Overview of Construction Industry in China

As we know, the development of CI indicates the development of industry, agriculture, science and technology and economic civilization, and the social progress of a country or an area. China's CI has occupied an indispensable status in national economy building and has hugely promoted the national economy. China's modern CI was established upon the declaration of the People's Republic in 1949, to rebuild the war-damaged cities, with personnel gathered from the construction forces and demobilized soldiers in the engineering regiments (Ofori and Han, 2003). China's Ministry of Construction Engineering[6] was set up in 1952. In the Great Cultural Revolution which started in 1966, this ministry was disbanded. Obviously, China's CI has undergone significant changes in the past decades. It was formerly known for its low efficiency and effectiveness. Under the old planned economic system in place before the 1980s, the Chinese government was not only responsible for freely providing all of the finances for construction works but was also responsible for assigning construction projects to contractors (Laia; Liub and Wang, 2004). Led by the 'reform and open door' policy in 1978, the Chinese government translated its purely planned economic system into a market-oriented system. In response to the national reform programme, a number of reform policies have been implemented in the China's CI. Fan (1988) described the China's CI in the late 1980s as having many experienced design offices in China; but due to lack of exposure, their design knowledge was limited thus restricted their choice of materials, equipment and other construction elements. For example, there were no independent professional PM companies in the Chinese construction market until 1988 (Liu and Shen, 2004). The

[6] It instituted policies to support the industry's technological and human-resource development to achieve the ambitious economic development targets under the first Five-Year Plan (1953–1957) (Ofori and Han, 2003).

reform of the CI was launched in the mid-1980s in China. Since then, considerable progress has been made. The construction market has been gradually developed and the framework of a regular system has been roughly established with a large number of laws, regulations, rules and codes enacted by government departments at all levels (Sha, 2004). The main construction business related laws are as shown in Table 2.1:

Table 2. 1 The main construction business related laws[7]

Law	Adopted Date
Arbitration Law	31 August 1994
Construction Law	1 November 1997
Land Administration Law	29 August 1998 (revised)
Contract Law	15 March 1999
Tendering and Bidding Law	30 August 1999

China's CI paid about 181,300 million dollars in the year of 2000, accounting for 17.2 percent of GDP in China[8]. It is a very important part of the national economy, and takes a significant role in solving the employment of spacious labour and improving the living standard of people. These changes had induced Chinese construction market to apply competitive methods to improve the effectiveness and efficiency of construction activities and towards international procurement practices[9]. Table 2.2 provides the ranking of Top-10 Chinese construction corporations.

[7] Source: Adapted from Sha (2004).

[8] Source: National Bureau of Statistics of China, http://www.stats.gov.cn/english/statisticaldata/.

[9] Recent years, China has been titled "The biggest building site in the world". A few years ago, there was a saying in Wall Street that is a corporation not entering China is not an international corporation, and this comes real nowadays. Most World Top-500 Enterprises have entered Chinese market, and there are quite number of construction related firms, such as Weyerhaeuser Company, United Technologies Corporation (UTC), Schneider Electric, and so on.

Table 2. 2 Ranking of China Top-ten Construction Corporations[10]

National Bureau of Statistics of China in Year 2002					
Rank	Chinese Construction Corporation Name	Abbreviation	Turnover (billion RMB)	Total Assets (billion RMB)	Employee No.
1	China State Construction Engineering Corporation	CSCEC	63.8	74.1	228,916
2	China Railway Engineering Corporation	CREC	47.0	47.8	272,437
3	China Railway Construction Corporation	CRCC	46.1	39.1	169,806
4	China Metallurgical Group Corporation	MCC	24.8	26.3	104,997
5	China Harbor Engineering Corporation Group	CHEC	20.2	28.0	41,214
6	China Road & Bridge Corporation	CRBC	14.4	14.2	23,972
7	Shanghai Construction Group	SCG	14.1	21.8	37,152
8	Beijing Urban Construction Group	BUCG	10.3	21.8	27,023
9	Beijing Construction Engineering Group	BCEG	9.2	15.4	28,728
10	Shanghai Urban Construction Group	SUCG	7.0	10.0	12,670

In China, all large construction firms were state-owned establishments under the traditional planned economy system. Since the adoption of the reform, the traditional planned economy system has been gradually replaced by the market economy in China. A great number of peasants were liberated from traditional cultivation and farming works and organized themselves into rural village-enterprises and rural construction teams (RCT). This was closely associated with the rapid economic expansion, which results in high volumes of construction activities and leads China the largest construction market in the world (Tam, Zeng and Deng, 2004). Figure 2.1 represents the proportion of RCT, state-owned enterprises (SOE), urban

[10] Source: Adapted from National Bureau of Statistics of China, http://www.stats.gov.cn/english/statisticaldata/.

collective-owned (UCO), and others[11] construction enterprises in China in 1999. It suggests a great change in the form of ownership of construction enterprises in China.

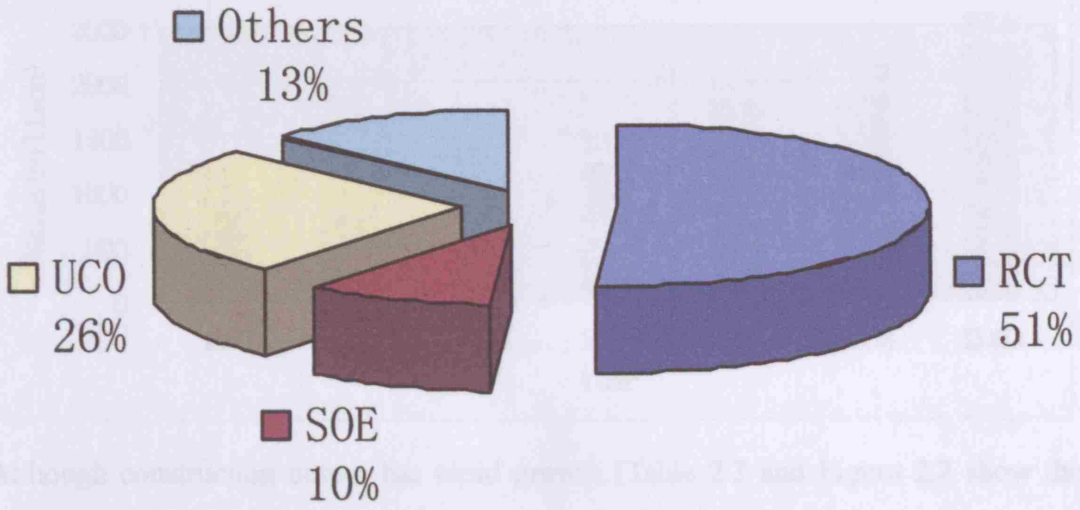


Figure 2. 1 Categories of Chinese construction enterprises of various ownerships in 1999[12]

Nowadays, China's CI ranks amongst the largest in the world[13]. In particular, the Chinese construction market is undergoing an unprecedented expansion after its accession to WTO in 2001. All these should be affirmed at first; however, it has many problems due to subjective and objective reasons, which need continuous modification and solving.

Table 2. 3 Total Output Value of Construction (10,000 yuan)[14]

Year	Value (billion Yuan)
1997	913
1998	1006
1999	1115
2000	1250
2001	1536
2002	1853
2003	2308

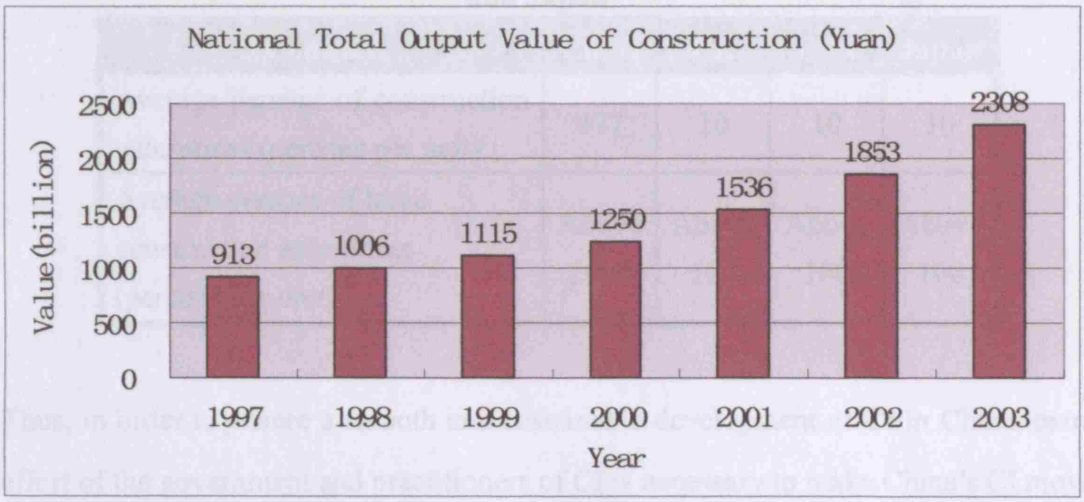
[11] Including public-listed sharing-holding, foreign-funded enterprises.

[12] Source: Adapted from Tam, Zeng and Deng (2004).

[13] The gross output of the industry in 2001 soared to RMB2000.98 billion (approx. US$241.96 billion), which is about 58 times as much as it was in 1980 (Jin and Ling, 2006).

[14] Source: Adapted from National Bureau of Statistics of China, http://www.stats.gov.cn/english/statisticaldata/

Figure 2. 2 National Total Output Value of China's CI



Although construction output has rapid growth (Table 2.3 and Figure 2.2 show the Total Output Value of China's CI from 1997 to 2003.), the total output is much less when compared with the UK, and the USA. Obviously, there are great gaps between the construction of China and developed countries. Thorough research has found some China's CI problems have been significantly reduced since the 1990s yet; many of them still exist nowadays. For example, the quality[15] management[16] (QM), low mechanisation caused by labour-intensive, unsound regulation systems, management level, irrational scale of construction enterprise, cross-cultural problems, and so on. Such as the scale of construction enterprise, we can refer to Ye's (2001) work about comparing the scale of Chinese construction enterprises with developed countries (shown in Table 2.4), and pointing out that the average scale of Chinese construction enterprises is about 50 times as big as developed countries, and the average scale of Chinese large construction enterprises is 20 times as big as developed countries. It is obvious that the average number of persons engaged in each Chinese enterprise is tens times as much as developed countries, but the average profit rate in China is six to one with developed countries.

[15] In order to meet recognised international requirements, China is gradually adopting international quality standards, such as ISO9000 and developing its own quality standard – GB/T19000 – based on the international standard (Flanagan and Li, 1997).

[16] Quality management has been defined by CIRIA as aspect of the overall management function that determines and implements the quality policy (Churcher, 1996).

Table 2. 4 Comparing of construction enterprise scale among China, UK, USA and Japan[17]

Country	China	UK	USA	Japan
Average persons of construction enterprises (persons per unit)	477	10	10	10
Average persons of large construction enterprises (persons per unit)	Above 2000	Above 100	Above 100	Above 100

Thus, in order to ensure a smooth and sustainable development of CI in China, extra effort of the government and practitioners of CI is necessary to make China's CI move towards a global outlook.

2.2 Circumstance of Subcontracting Practices in China

The CI is unique compared to other industries[18], and the China's CI is characterised by the common practice of multi-level subcontracting. Due to the increase of development and competitive of China's CI, expansion of the specialisation and project scale for construction activities, subcontracting has become a popular phenomena in China. Chinese subcontractors can be divided into two types. Labour only subcontractors which provide nothing but labour. Another type of subcontractors provide labour, materials, plant and other resources necessary to complete the subcontracted part of the project.

A well-developed body of Construction Law makes it possible for transactions to occur smoothly when contract system is incomplete. However, Chinese Construction Law is still on its progressing phase. Such as the doctrines of Construction Law are phrased in broad language ("reasonable time", "reasonable price", "rational workload", etc.) that is open to differing interpretations when applied to specific

[17] Source: Adapted from Ye (2001).

[18] Because each construction project is different, the work force is transient, multiple crafts are involved, projects are planned and worked in short time frames and there is a tremendous variety of materiel and equipment that must be installed (Olson, 1998).

transactions. Unethical subcontracting is another serious problem. Many public projects are awarded to qualified construction companies but then dismembered and passed on to unqualified subcontractors. A project may be subcontracted several times, and each time a higher-level contractor collects 'management fees' from the lower-level contractor. All these facts illuminate that there are great gaps between the China's CI and developed countries'. In recent decades, due to the main contractors' wish to spread responsibility, a growing large percent of construction activity is now subcontracted in the majority of contracts in China. In many instances, however, inexperienced main contractors of civil construction enterprises base their subcontracting decisions on cost issues. Many companies decide to "buy" rather than "make" for short-term reasons of cost reduction and capability, but countries have to think for longer term for their national interests. Therefore, practitioners of China's CI have to pay attention to the subcontracting practices, such as how to minimise the expected cost by making a correct make-or-buy decision for subcontracting activities in China's CI.

Chapter 3. Understanding Transaction Cost Theory

The following Chapter 4 will contain a detailed description of the methodology for analysing the subcontracting practices in China's CI. Before commencing on this task, a brief overview of transaction costs (TCs) and its effect on make-or-buy decisions are presented in this chapter.

3.1 The Concept of Transaction Cost Theory

This research will apply one of the most important economic theories — Transaction cost theory (TCT)[19] to explain the subcontracting practices China's CI. The concept of transaction cost[20] (TC) was first described by Ronald Coase (Coase, 1937) in his famous paper "The Nature of the Firm". He draws attention to the question of what determines the boundaries[21] of the firm — that is, what factors relate to a firm's decision to contract out some of its activities rather than to perform them within the firm — the 'make-or-buy' decision. TCE is one of several approaches that have been taken to address this question (Fredland, 2004). TCE theory identified that under certain conditions the costs of using the market would be such that the firm would decide to internalize a transaction through making in-house (Jacobides, 2005). TCT is perhaps most often applied to understanding vertical integration (VI)[22]. Make-or-buy decisions determine the firm's level of VI, since each decision specifies which operations the firm will engage in and which it will contract out to a supplier. Hence, it is being given more consideration within organisations because of its strategic

[19] TCT is most associated with the work of Williamson (1981) who explains the formation of 'hierarchies' and the nature of the modern corporation chiefly in terms of internalising transaction costs within the organization and thus saving on these costs.

[20] Transaction costs are the costs associated with conducting an economic exchange, such as search, selection, bargaining, monitoring and enforcement (Madhok, 2002).

[21] Boundary choices are decisions of primary strategic importance. Over the past 20 years, TCE has emerged as a predominant theoretical explanation of boundary choice (Poppo and Zenger, 1998).

[22] Say, in the CI, the choice of the ways to obtain subcontracts or the make-or-buy decision of subcontracting would be based on its transaction cost.

implications.

The conceptual basis for the make-or-buy decision is Williamson's (1975) theory of transaction cost analysis (TCA), who identifies three key characteristics of transactions that together suggest the most efficient organisation of production: uncertainty, asset specificity and frequency. TCA combines economic theory with management theory to determine the best type of relationship a firm should develop in the market place. The TC perspective is valuable given its consideration of both economic and behavioural influences. Bowersox and Cooper (1992) identify six key influences on transaction costs. Figure 3.1 presents all six factors as they relate to TCs and the subsequent make-or-buy decision.

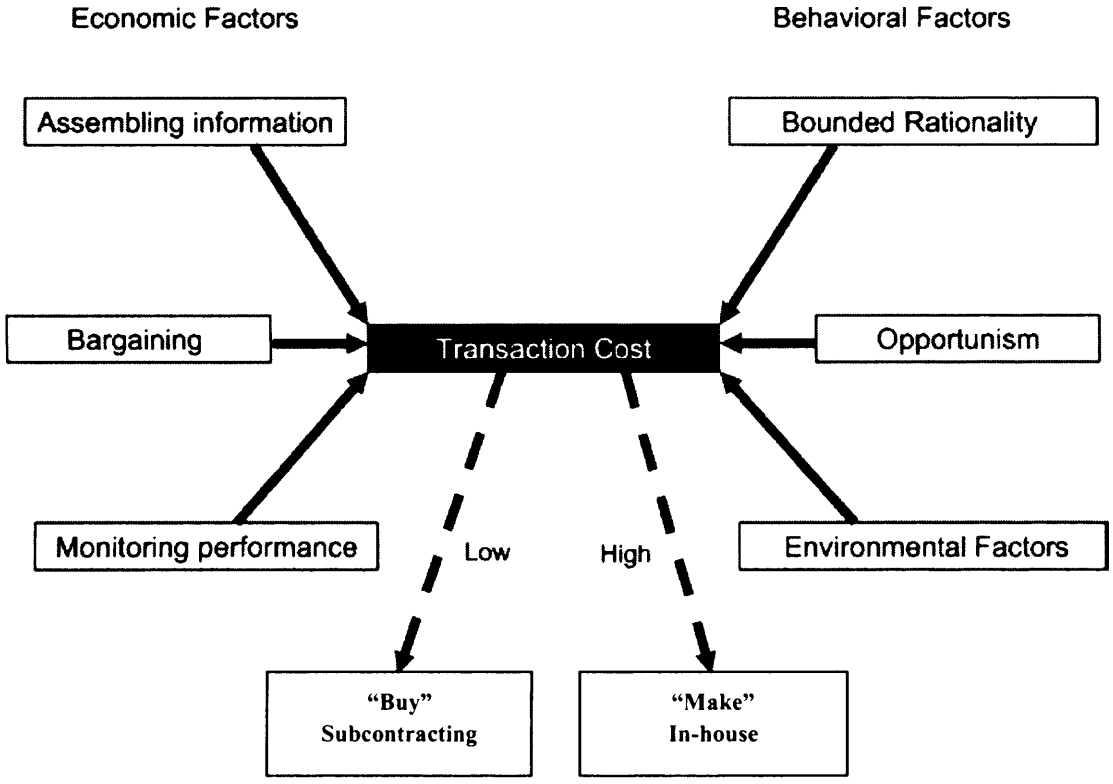


Figure 3. 1 The Transaction Cost Framework[23]

Canez and Probert (1999) divided the reported approaches of 'make-or-buy' into two main categories: those related to economics[24] and those which take a strategic[25]

[23] Source: Adapted from Bowersox and Cooper (1992).

[24] The economics-based approaches deal with mathematical, probabilistic and costing models which use cost factors to answer the question "should the company produce in-house or outsource?" (Canez and Probert, 1999).

management viewpoint. To address the issue of human involvement in the make-or-buy decision, Mantel et al. (2005) integrate two sets of literature: the operational make-or-buy literature[26] and the behavioural decision-making literature[27]. Make a comprehensive survey of the make-or-buy decision literature, many researchers have pointed out determinants of make-or-buy decisions and hypothesis models with different variables. Masten (1984), a representative example, found that more complex components for the aerospace industry were more likely to be produced internally than to be outsourced.

3.2 Prior Studies of Make-or-buy Decision

Over the last two decades, various researchers have elaborated on the TCE approach of make-or-buy decisions. Walker and Weber's (1984) study focuses on make-or-buy decisions as a paradigmatic problem for analysing TC. They developed some hypotheses from Williamson's efficient boundaries, and tested them in a multiple-indicator structural equation model. Their results show that comparative production costs are the strongest predictor of make-or-buy decisions and that both volume uncertainty and supplier market competition have small but significant effects[28]. Argyres (1996) found that the decision about whether to make-or-buy was based on both capabilities and TCs, this finding replicated in large-scale studies (i.e. Jacobides, 2005).

Several authors have argued about under what circumstances and conditions the firm should choose internal or external relationships or contracts (Brandes, Lilliecreutz and

---

[25] A strategic viewpoint considers other factors in addition to cost (Canez and Probert, 1999).

[26] The operational make–buy literature prescribes whether insourcing or outsourcing is appropriate in a particular situation. This literature has evolved over several decades, initiating with a primarily economic perspective focusing on minimization of costs, evolving to add an intellectual capital perspective that accounts for distinctive competence implications, and further growing to consider supply risks (Mantel, et al. 2005).

[27] The main factors addressed in the behavioral decision-making literature are task-related characteristics of the decision and decision process, personal characteristics of the decision maker and contextual characteristics of the particular decision (Mantel, et al. 2005).

[28] The findings are explained in terms of the complexity of the components and the potential pattern of communication and influence among managers responsible for making the decisions.

Brege, 1997). On a basic of review and discussion of the literature on strategic purchasing and in particular the make-or-buy decision, McIvor et al. (1997) developed and outlined a generic model of the make-or-buy decision-making process[29]. The stages involved in the make-or-buy model are illustrated in Figure 3.2.

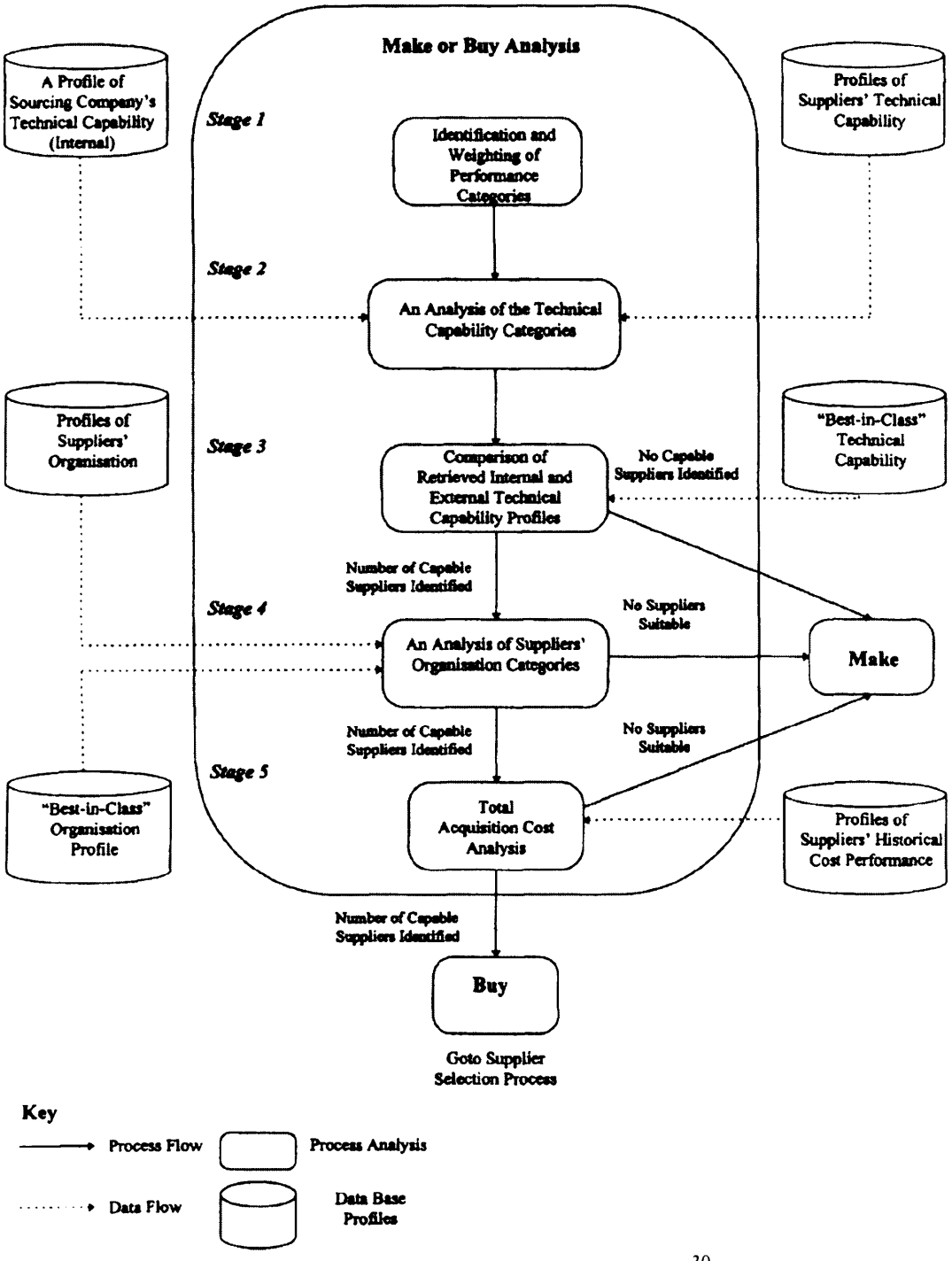


Figure 3. 2 The Make-or-buy Model[30]

[29] The model, however, is not a panacea for all of the problems associated with making an effective make-or-buy decision (McIvor, et al. 1997).

[30] Source: Adapted from McIvor et al. (1997).

An important implication of McIvor's model[31] is that organisations should give strategic attention to the make-or-buy decisions; some of the factors such as capability and suppliers' historical performance are also involved in my hypotheses. Not only McIvor et al. (1997) describe how knowledge-based systems (KBS) technologies and multi-attribute analysis can assist an organisation in the decision-making process, Humphreys and Huang (2002) also discuss a KBS[32] designed to help companies in the make-or-buy decision, which is arguably the most fundamental component of manufacturing strategy. Besides this, a make-or-buy framework has being developed as part of a make-or-buy research project at the University of Cambridge, aims to provide a structured, holistic view for make-or-buy reviews. It illustrates how factors from the external environment (e.g. competition) activate the trigger(s) (e.g. cost reduction) which raises the make-or-buy query (Canez and Probert, 1999).

Since the increasingly adopt 'buy' decision, many researchers have attempted to overcome some of the problems associated with outsourcing. Blaxill and Hout (1991) found that many firms make sourcing decisions primarily on the basis of overhead costs, saving most on overhead costs, rather than making the most long-term business sense. Lonsdale and Cox (1997) found many firms make insourcing or outsourcing decisions primarily on the basis of reducing headcount and costs. The choice of which parts of the business to outsource is made by ascertaining what will save most on overhead costs, rather than on what makes the most long-term business sense. Similarly, subcontractor choosing, due to its intrinsic ambiguity and difficult formalisation, is a particularly complex task for main contractors[33], usually dictated by management experience. Vining and Globerman (1999) provided a conceptual

[31] A practical framework for evaluating the outsourcing decision which is also developed by McIvor (2000) is presented in *Appendix 5* Figure 5.1.

[32] The model consists of five main stages: identifying and weighting performance categories; analysing technical capabilities; comparing internal and external capabilities; analysing supplier organisational capabilities; total acquisition cost analysis (Humphreys and Huang, 2002).

[33] In a competitive bidding for the subcontracting of a part of a project, the general contractor management has to rate the competitors; considering several information related to the specific project.

framework[34] to assist managers in identifying and implementing outsourcing decisions. Three major determinants of outsourcing costs were delineated in their work: product/activity complexity, contestability and asset specificity. Leiblein et al. (2002) investigated how firms' decisions to outsource or internalize production affect their technological performance. Platts et al. (2002) also found the traditional approaches to questions of make-or-buy have been based on financial and economic criteria, and developed a process for making structured make-or-buy decisions. Recently, Görg and Hanley (2004) focused on the question as to whether outsourcing increases firms' profitability. They investigate the relationship between outsourcing and profitability paying particular attention to the direction of causality. Buehler and Haucap (2004) employed a concept of strategy based on modern game theory, argued that outsourcing decisions should not only be based on the direct effect that outsourcing has on an organisation's profits, but also on the strategic effects that affect these profits indirectly.

Noticeably, a study to investigate the factors affecting the making of make-or-buy decisions and the creation of a process based on a framework[35] to guide industrial companies through making such decisions was described by Platts, Probert and Cáñez (2002). The process comprises three phases: a preparation phase[36]; a data collection phase[37]; and an analysis and results phase[38]. This framework[39] shows how the external environment usually activates triggers for the make-or-buy analysis[40],

[34] In particular, the framework suggests a way for managers to identify the pre and post-contractual risks associated with outsourcing decisions along with strategies that can be implemented in the pre-contractual stage in order to mitigate those risks (Vining and Globerman, 1999).

[35] This framework is a graphical representation of why operational make-or-buy decisions are made and shows relevant dimensions to be studied in approaching such decisions (Platts, et al. 2002).

[36] In this phase the preparatory work for the project occurs. The project team is selected and briefed and the component family or process to be considered is identified and specified.

[37] The essence of the process is the weighting of the relative importance of the various factors in the framework, and the rating of the performance of in-house and external supply against each of these.

[38] In the third phase, the results of the weightings and ratings are combined to give a single figure which provides an indication of the relative merits of making or buying when a wide range of factors are taken into account.

[39] Their framework, shown in *Appendix 5* Figure 5.2, was developed from a review of the literature, interviews with industrialists, and exploratory industrial case studies.

[40] For example, increased price competition in the market place forcing a company to look at ways of reducing cost, might raise the make-or-buy question.

suggests four areas within which to cluster factors that need to be considered when make-or-buy decisions are made: technology and manufacturing processes, costing, supply chain management and logistics, and support systems[41].

3.3 The Established Practice in TCE

An effort is made here to summarise the way that the variables associated with this study are measured in the TCE literature (shown as Table 3.1).

Table 3. 1 The Measurement of Variables in TCE

Scholars	Main issues of this study	Key variables in TCE	Proxy variables	Measurement	Source of data
Masten (1984)	Make-or-buy decisions for aerospace industry	Asset specificity		Dummy variable (if the item is highly specialised)	Rating system used internally by the company
		Uncertainty	Complexity	Dummy variable (if the item is rated as complex)	Procurement team of the company
Walker & Weber (1984)	Make-or-buy decisions for a US automobile company	Uncertainty	Volume uncertainty	Expected volume fluctuations: The extent to which significant fluctuations are expected in the daily or monthly volume requirement for the component. Uncertain volume estimates: The extent to which volume estimates for the component are expected to be uncertain.	The data consisted of 60 decisions made in a component division of a large U.S. automobile manufacturer over a period of three years. The information for these 60 components was considered inadequate by the managers
			Technological uncertainty	Changes in specifications: The frequency of expected changes in specifications for the component. Technological improvement: The probability of future technological improvements of the component.	
		Supplier production advantage	Difference in manufacturing process	The extent to which substantial differences in manufacturing processes for the component between outside suppliers and the buyer favour the outside suppliers.	

[41] The arrows coming out from the performance measures to the external environment suggest that the measures are being continually reassessed in the light of environmental change.

			Difference in scale of operations	The extent to which substantial differences in the scale of operations for the component between outside suppliers and the buyer favour the outside suppliers.	in the division for a competent decision to be made.
			Annual savings to make a component	The natural logarithm of the division's estimate of the annual savings to make as opposed to buy a component.	
		Competitio n among suppliers	Competitive quotes	The extent to which it is difficult to judge the competitiveness of outside quotes on a component.	
			Number of suppliers	The extent to which there are enough potential suppliers to ensure adequate competition for the supply of the component.	
			Supplier proprietary technology	The extent to which leading outside suppliers of the component have proprietary technology that gives them an advantage over other producers.	
		Buyer experience	Buyer tools and equipment	The degree of similarity between the tools and equipment required to manufacture the component and those the buyer already uses.	
			Buyer manufacturin g technology	The extent to which the buyer has strong expertise in the technology required to manufacture the component.	
Coles & Hesterly (1998b)	Make-or-buy decisions for hospital industry	Asset specificity	Physical asset specificity	A five-point scale with one being low and five being high.	Through pre-survey interviews with hospital administrators , then 204 participants returned the survey, or almost 27% of the sample population.
			Human asset specificity	A five-point scale with one being low and five being high.	
		Uncertainty	The rate of technological change	A four-point scale with one indicating the least change and four indicating the most change.	
		Economies of scale	Hospital size	The natural logarithm of the number of beds the hospital supports.	
		Industry-sp ecific services		Dummy variable (one for medical industry-specific services, zero for non-industry-specific services)	
		Market size		Ask respondents the number of hospitals currently servicing their hospital's market area.	
Poppo &	Measurement	Firm-specif	Human and	Use three items to measure the degree	Hypotheses

Zenger (1998)	explanations for make-or-buy decisions in information services	ic assets	physical assets	used to produce an information service were custom-tailored to a firm using a 7-point scale.	are tested using data on the governance of nine information services at 152 companies.
		Measurement difficulty		Measurement focused on the level of difficulty in measuring worker performance using a 7-point scale.	
		Technological uncertainty		Measure the degree of change in both skills and technology using two items using a 7-point scale.	
		Skill set		The degree to what performing this function require personnel with extensive knowledge and skills using a 7-point scale.	
		Economies of scale		The degree to which a firm had scale sufficient to support the efficient production of a services using a 7-point scale.	
		Firm size		The number of employees in the company and used the log of size in the analyses.	
González-Díaz; Arruñada & Fernández (2000)	Subcontracting decisions in CI	Asset specificity	The number of firms manufacturing each product	Estimate each firm's specificity in each year (E_{it}), weight them with the share of each product in the firm's total production. Obtained through direct interviews or in other indirect ways.	Information was obtained from a questionnaire survey on a panel of firms in the CI over 6 years
		Uncertainty		Computed as the annual average of the absolute value of quarterly variations in the number of the firm's workers with respect to the previous month.	
		Homogeneity	Geographical dispersion	The number of provinces (from 1 to 52) in which a firm works	
			Diversity of output	The number of different tasks (from 1 to 12) that the firm takes on.	
		Technological specialization	Intangible assets	Measured specialization in technical activities as the percentage of the firm's annual sales coming from selling services related to studies, projects and research in architecture, engineering, and supervision.	
White (2000)	Make, buy, or ally decisions of Chinese state-owned	Competition	Number of suppliers	Total number of research institutes	The data are based on the registration records for all
			Number of rivals	Calculated as the number of firms that from 1985 to the decision year	

	pharmaceutical manufacture firms		Highly competitive region	Categorized 7 of China's 30 province-level administrative regions as highly competitive. 62 of China's top 100 firms are located in, coded 1 if it was in one of these regions and 0 otherwise.	bulk active ingredient compounds approved by the Chinese Ministry of Public Heath (MPH) for sale during 1985-94. Obtain a final sample of 112 decisions by 87 firms.
		Experience	Experience in same therapeutic category	Coded the dummy variable experience in some therapeutic category.	
			Experience in dependent development	Dummy variable	
		Competency	Me-too drug	Use MPH's categorization of a compound's newness to create a dummy variable.	
Bigelow, Lyda S. (2004)	Make-or-buy decision revisited by utilizing a comprehensive, longitudinal dataset in automobile industry	Asset specificity	Technical specifications of each engine	The transaction variables are designed to capture characteristics of the engine. Four variables are continuous measures: cubic displacement (cc), horsepower (hp), and the diameter of the cylinder (bore), the length of the cylinder (stroke).	A research team headed by Carroll[42] and Hannan[43] with data on components and suppliers that was collected separately.
		Supplier availability	The overall economic climate	The number of suppliers, since GNP is highly correlated with the engine supplier's variable, use total industry production.	
Mantel; Tatikonda & Liao (2005)	Factors influencing the make-or-buy decision	Core competency		Manipulated in the scenarios by describing the object of the make versus buy decision as either an "important" sub-assembly (high core competency) or "peripheral" sub-assembly (low core competency).	Respondents were randomly chosen from the members of ISM based on two-digit SIC codes

[42] Carroll, Glenn R.; Bigelow, Lyda S.; Seidel, Marc-David and Tsai, Lucia (1996), "The fates of de novo and de alio producers in the American automobile industry 1885-1981", *Strategic Management Journal*, Vol. 17, pp. 117-137.

[43] Hannan, Michael T.; Carroll, Glenn R.; Dundon, Elizabeth A. and Torres, John C. (1995), "Organizational evolution in multinational context: entries of automobile manufacturers in Belgium, Britain, France, Germany and Italy", *American Sociological Review*, Vol. 60, pp.509-528.

		Information source		Manipulated within the scenarios by describing the information available to make the decision as either informal or formal	representing companies in the fabricated metal products, machinery, transportation equipment and instruments and related products industries.
		Strategic vulnerability	Risk of outsourcing	Measured via a one-item risk assessment ranging from extremely low (3) to extremely high (3)	
Peng, Mike W.; Zhou, Yuanyuan & York, Anne S. (2006)	Make-or-buy decisions in export strategy	Market distance	Geographical distance	Between the USA and other countries, using the great circle distance (in miles) between major ports of the USA and the export destination countries	Data from the top 10 states in terms of annual export value
			Cultural distance	Using the paradigm developed by Ronen and Shenkar[44] (1985) for cultural clusters and updated by Peng[45] et al. (2000).	
		Product complexity	Product commodity level classification scheme	High, medium, and low, classified by U.S. Customs for each two-digit HARM code product category.	

From Table 3.1, it is clear to find the key and proxy variables in TCE, their measurement, and the data collection means. Just as most TCE empirical literature, a majority of variables in this study are not easy to obtain objective estimates. Thus, like many of important TCE empirical studies (as list in Table 3.1), such as Coles and Hesterly (1998b), Poppo and Zenger (1998), I adopt a 10-point scale to measure these variables, which also has concerned the habit of Chinese interviewees when doing subjective direct measure of variables. These variables in Table 3.1 are which had been concerned to bring the hypotheses in Chapter 5 as well.

[44] Ronen, Simcha and Shenkar, Oded (1985), "Clustering Countries on Attitudinal Dimensions: A Review and Synthesis", *The Academy of Management Review*, Vol. 10, No. 3, pp. 435-454.

[45] Peng, Mike W; Hill, Charles W. L. and Wang, Denis Y. L. (2000), "Schumpeterian Dynamics Versus Williamsonian Considerations: A Test of Export Intermediary Performance", *Journal of Management Studies*, Vol. 37, No. 2, pp. 167-184.

Chapter 4. Research Methodology

4.1 Approach of This Study

I adopted a two-pronged approach for the study. On the one hand, this research is based on an extensive critical literature review of the theories of the TCE and make-or-buy decision that rely on which to promulgated some hypotheses of the influencing factors for subcontracting practices in China's CI; on the other hand, it was based on meetings and face-to-face in-depth interviews with five Chinese first–tier construction firms. Interviewees were six contractors, managers and professionals from these concerned firms. This was supplemented by collecting data from these interviews to testing the aftermentioned hypotheses in Chapter 5 with some statistical methods.

4.2 Data Collection

Due to expected small numbers of the respondents or the low dependability and veracity of the responses by sending questionnaires, quantitative analysis will be difficult for this research. Whereas, it is not the only reason I choosing to do interviews. The standard program of scientific research in economics is to (a) develop a theory of some phenomenon, (b) formulate it in econometric tens, and then (c) test it with actual data (Blinder, 1991). The reason I used interviews is also due to: (a) gain the information most directly, (b) in China, since its national culture and situation it is easy to do interviews and collect data, (c) interview is the most efficient way for my subjective direct measure when under the condition without objective measure variables, in principle.

Economists, more so than other social scientists, are skeptical that you can learn much by asking people. We are trained to study behaviour by watching what people (usually in markets), not by listening to what they say (Blinder, 1991). But, in the case of

make-or-buy decision of China's CI, people have no particular reason to conceal the truth[46]. As long as people are not pathological liars, interviews may educe useful information. Therefore, interviews and personal contacts are the main methods of collecting data in this research. It is a qualitative method in order to collect different views from the respondents because the respondents will be those who have or have had direct experience for subcontracting practices in China. All the data in this research came from meetings and interviews of five Chinese top-ten construction companies which are involved in the factors that influence the make-or-buy decision of subcontracting practice in China's CI. I draw the data from six in-depth interviews with main contractors or professionals of these Chinese construction companies. Their insights and cooperation, along with the results from an extensive literature review, helped in survey development.

4.3 Selection of the Interviewees

The next step, to launch the interviews, is one of the most important procedures in the whole process of my research. As mentioned above, I would like to contact with the Chinese first–tier construction firms, which can represent the circumstance of China's CI typically. Although SOEs in China are facing a crisis, unlike the entrepreneurial sector, including private and collective enterprise, which has grown rapidly and with essentially no central government financial support since 'reforms and opening-up' began in the 1980s (White, 2000). The state-owned construction firms in China have still occupied an indispensable status in national economy building and remained a persistent promotion on the national economy. Therefore, I chose four top-ten Chinese state-owned construction firms from Table 2.2 to investigate and visit for my research. Due to China State Construction Engineering Corporation (CSCEC) is the top-one construction company in China, I select two main domestic organisations of it: China Construction Sixth Engineering Bureau (CCSEB) and China Construction Eighth

[46] To ensure that this was so, I abjured any questions about business secret, collusion, political factors, etc. In general, all the interviews are made to comfortable and easy to respond.

Engineering Division (CCEED). Table 4.1 shows all these selected organisations' profile of location, turnover, and number of employees.

Table 4. 1 The Interviewed Companies' Profile of Year 2005

Company	Abbreviation	Location	Turnover (billion)	Employee No.
Shanghai Urban Construction Group	SUCG	Shanghai China	12.1 RMB	11,898
Shanghai Construction Group	SCG	Shanghai China	36.6 RMB	30,000
China Construction Eighth Engineering Division	CCEED	Shanghai China	20 RMB	13,788
China Construction Sixth Engineering Bureau	CCSEB	Tianjin China	9.2 RMB	6,300
Beijing Construction Engineering Group	BCEG	Beijing China	20.7 RMB	20,800

The brief introduction of these interviewed companies was presented in *Appendix 3*.

4.4 Preparation for Interviews

Since the limitation of time, a good preparation for interviews will lead a successful outcome. In order to ensure an effective interview and get the best outcome for the research, the interviews must have clear objectives. Some problems of interviews demand full attentions listed in Table 4.2.

Table 4. 2 Matters Needing Attention for Interviews

No.	Items
1	Interviews must be conducted in a conducive environment, away from interruptions and distractions.
2	Try to make the interviewee feel comfortable and relaxed in order to contribute freely.
3	Time management during the interview is important[47].
4	Interviews should be directive in focusing on the topics, but should allow the interviewees to explore and express opinions and evaluations as well.

Considering about the above issues, I construct an outline for the interviews. An

[47] This is best achieved by using a structured interview technique, with a mixture of direct and oblique approaches (Simon, 1997). Therefore, an interview structure was shown Appendix 1 to introduce the supposed contents to capture during these interviews.

English version sample was given in Appendix 1 to introduce the structure of interviews. Besides evaluating the weightiness of measurement variables related to the hypotheses, in the interviews, I also try to test Eccles' (1981) study on seven reasons of subcontracting, investigate whether it can be applied to China's CI. The seven reasons of subcontracting were listed in Table 4.3 that Eccles ranked them from most important '1' to least important '7'.

Table 4. 3 Eccles' Seven Reasons of Subcontracting[48]

Rank	Reason
R1	Keep overhead costs low
R2	Lower construction costs
R3	Insufficient amount of work
R4	Supervision problems
R5	Keep equipment investment cost low
R6	Volatility in workload
R7	Miscellaneous[49]

Franks (1986) gave a figure of the traditional relationships between the parties engaged in a building project as shown in Figure 4.1.

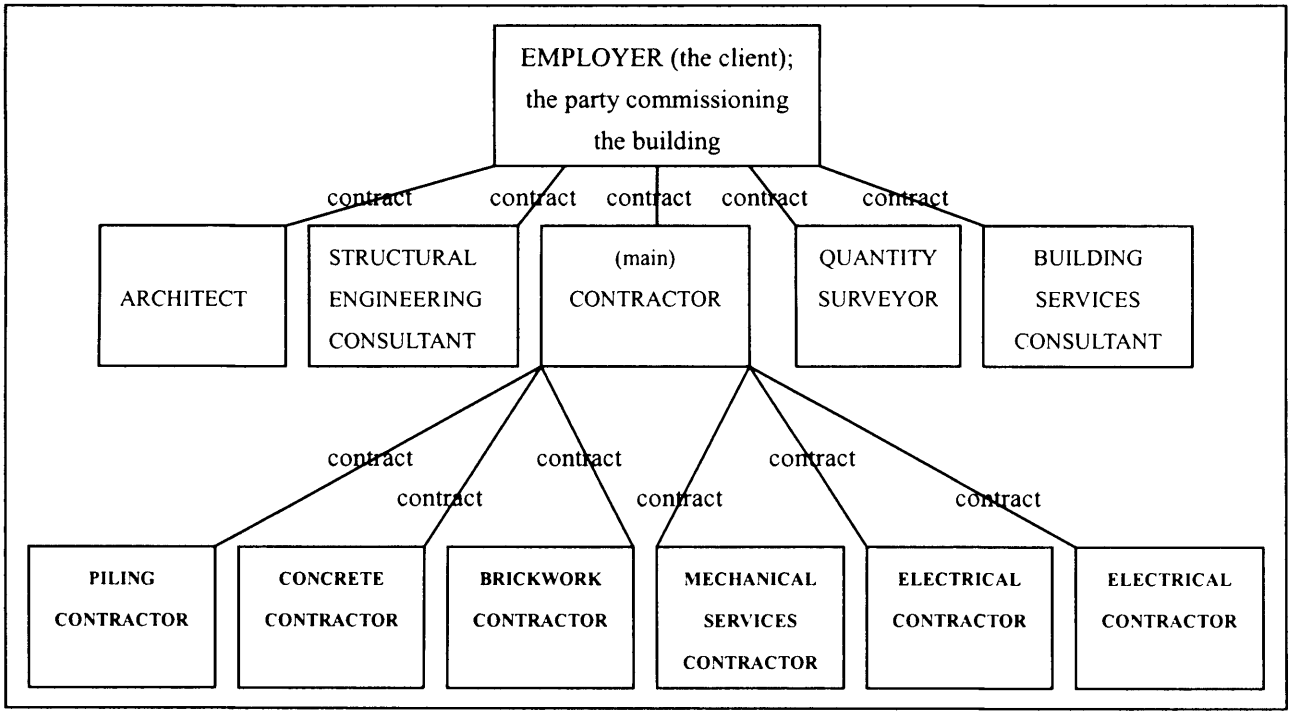


Figure 4. 1 Contractual relationships between parties engaged on a building project[50]

[48] Source: Adapted from Eccles (1981: 348-350).

[49] Such as for license, not own trade and faster construction time.

[50] Source: Adapted from Franks (1986:1).

In China's CI, however, the contractual relationships between parties are not exactly the same as western countries. Due to effect of the system of China's national state, Chinese Construction Law stipulates that "any part of the main body of a project cannot be contracted out". Hence, when doing the evaluation of the measurement variables in survey, the subcontracting classification of Chinese construction market cannot sort by different kinds of labours[51], but the different types of projects have been adopted and each project has some subentries. The categories of types of subcontracting for the interviews are shown in following Table 4.4. These categories are sorted on the basis of building type construction sectors.

Table 4. 4 Type of Subcontracting

Category	Type of Work	Type of Trade
1	Roof	Roofing
		Waterproof
2	Drywall Frames	Brickwork
3	Decoration & Fitment	Plastering
		Tiling
		Painting
		Flooring
4	Installation	Electrical
		Plumbing
		Heating & cooling
		Intelligent Building

The survey was conducted in July 2006 in China for the works. The first week was to prepare the interviews and contact these firms. In the following three weeks, I completed one interview in my hometown—Jilin province, northeast part of China—with a main contractor came from BCEG, then travelled to Shanghai for SUCG, SCG, CCEED respectively; Beijing for the BCEG and Tianjin for CCSEB at last. The interview flow chart is shown in Figure 4.2.

[51] It is because that if we sort by types of labours, the work like pilling and concrete also are included in the main body project, say, foundation. But foundation cannot be subcontracted in China. The main contractors have to use their own equipment, materials (say, concrete) and technology to build the foundation and main body of a building. What they can subcontract is only nontechnical labours.

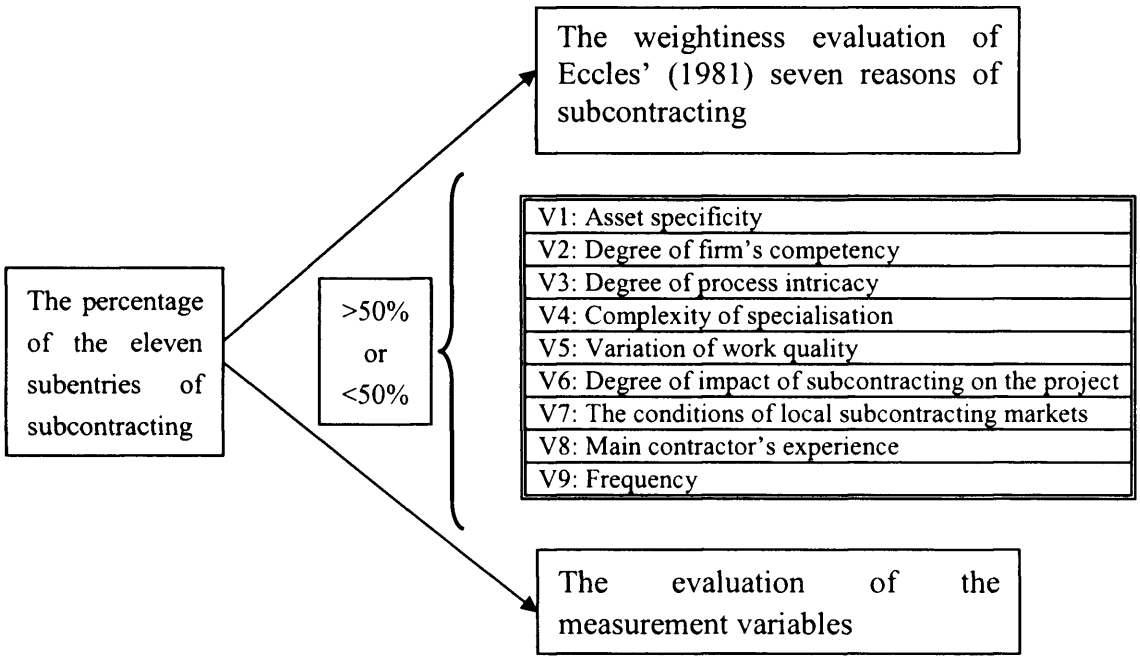


Figure 4. 2 Interview Flow Chart

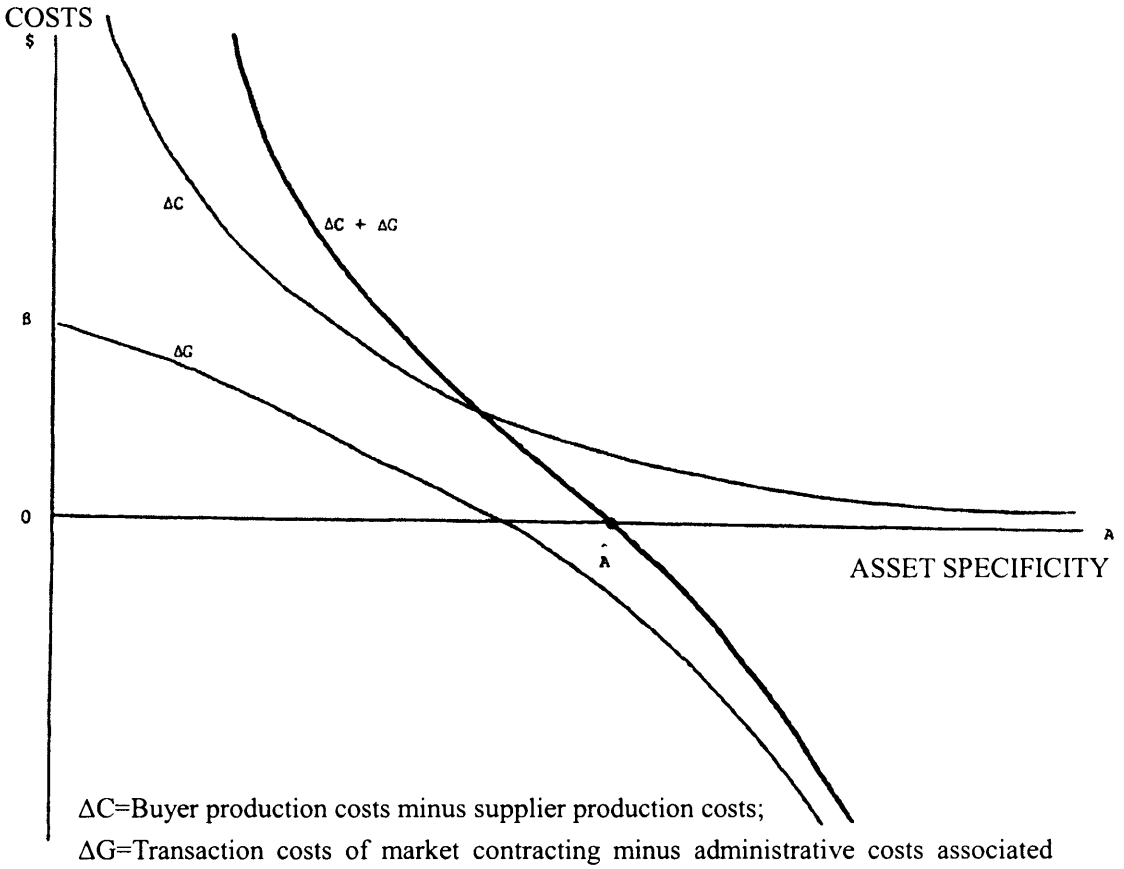
Chapter 5. Development of Hypothesis

On completion of the literature review and discussions, this section tries to formulate nine hypotheses of the key factors affecting subcontracting decisions in China's CI, which are mainly derived from TCT, TCE, and organisational capabilities perspectives. Then they will be tested in a sample of five Chinese state-owned construction firms' behaviours and interviews later.

5.1 Asset Specificity

Asset specificity is perhaps the most important element in Williamson's theory. Williamson's model of efficient boundaries implies when the administrative structure and technological base of the firm or the supplier market change, deintegration may be advisable (Williamson, 1981).

Williamson's model, shown in Figure 5.1, indicates that when asset specificity is low, suppliers enjoy a production cost advantage over buyers, since they are able to pool possibly uncorrelated or negatively correlated demand and thereby achieve smoother production schedules and greater economics of scale. Asset specificity refers to the extent to which an asset's value is determined by the continuance of a specific exchange relationship since it does not have wider exchange value (Gietzmann, 1996).



ΔC=Buyer production costs minus supplier production costs;
ΔG=Transaction costs of market contracting minus administrative costs associated with in-house production.

Figure 5. 1 Relationship between asset specificity and transaction and production costs[52]

There are various kinds of specificity including physical asset specificity, location specificity, human asset specificity, dedicated assets (Williamson, 1985) and temporal specificity (Masten et al., 1991). Most of the extant literature on buyer-supplier relationships has attributed a central role to the various types of asset specificity, in line with Williamson's TCE theory (Cooper and Slagmulder, 2004). Whatever the form of asset specificity, basically, the issue is the same: contracts which require either party to employ assets that have little or no alternative use, raise the potential for opportunism (Vining and Globerman, 1999). Extensive evidence suggests that asset specificity reduces the degree of subcontracting (e.g. Monteverde and Teece, 1982; Masten, 1984; Anderson, 1985; Ang, 1997; Jensen and Rothwell, 1998; Bigelow, 2004).

[52] Source: Adapted from Williamson (1981:560).

According to TCE, the degree of asset specificity is an important consideration in the subcontracting decision (Roodhooft and Warlop, 1999). If apply it to CI, immobility and uniqueness of output, the particular characteristics[53] of CI affect the relative importance of different sources of asset specificity. Site (location) specificity is not important because construction assets are mobile and relocating them is relatively inexpensive. Also, physical specificity will depend on the type of construction because the productive assets are usually designed for a particular kind of work or product and not for a particular project[54]. For the human asset specificity, dedicated assets, however, there is probability of hold-up problems if there are few firms offering similar products or professionals in a nearby market. For instance, the green building (Building Energy Efficiency) specialist or consultant, they specialise in small markets. Thus, a proposition can be stated as follows:

Hypothesis 1 (H_1)

For human asset specificity[55], there is a positive relationship between asset specificity and vertical integration in CI. Asset specificity reduces the degree of subcontracting.

5.2 Degree of Firm's Competency

Another term that is often used in connection with subcontracting is 'core competence'. The concept of it is developed by Hamel and Prahalad[56]. However, firm's competencies are not the same meaning as core competencies that should not

[53] In contrast with that of many other industrial sectors, the construction product is immobile, dispersed geographically, and varies in size and composition (Debrah, and Ofori, 2001). Lai (2000) also points out that subcontracting is closely related to product specificity, i.e., often it is tailored to suit the specific needs of specific clients, typically those in the CI. Subcontracting is well suited to this industry because projects are unique and specific in terms of type, size, class, location, time, sum, technology, specification and the like.

[54] Therefore, physical specificity will be directly related to the extent of the market, in indirect proportion to the number of firms that could use the assets (González-Díaz; Arruñada and Fernández, 2000).

[55] Say, green building (Building Energy Efficiency) specialist.

[56] A core competence is a bundle of skills and technologies that enables a company to provide a particular benefit to customers (Hamel and Prahalad, 1994).

only be limited to the activities most critical to the construction firms' future success, There could be a bundle of competencies that are widespread in a corporation, also bringing about sustained competitiveness besides core competencies. Javidan (1998) defined capability, competence, core competency and organisational resources in a hierarchy as presented in Figure 5.2.

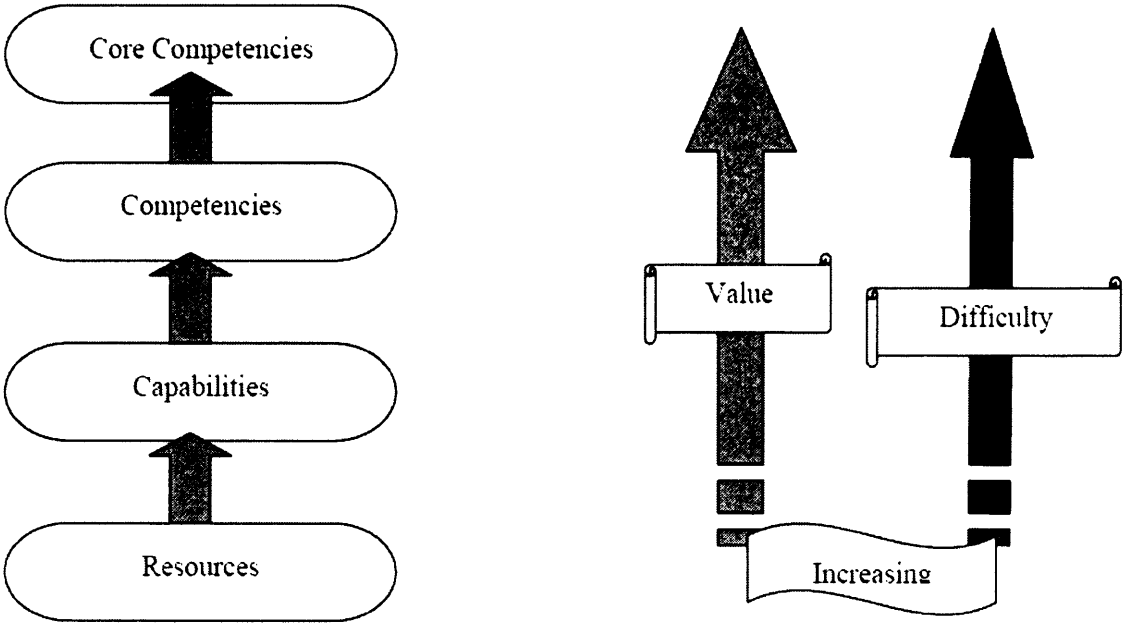


Figure 5. 2 The Competencies Hierarchy[57]

The degree of firm's competency indicates that the capability of the firm to conduct various activities. If a firm subcontracts an activity, it only needs to monitor the quality of the output, whereas if the firm vertically integrates such an activity it has to know the details of the production process (González-Díaz; Arruñada and Fernández, 2000). Hence, a firm's competency level influences the subcontracting decisions. In other words, the greater the number of activities a firm has comparative advantages for monitoring, the lower its likelihood of subcontracting an activity, so the hypothesis can be stated as follows:

[57] Source: Adapted from Javidan (1998).

Hypothesis 2 (H2)

For different types of work, when contractors are more able to undertake a type of work (high degree of firm's competency), it is more likely to find this type of work is carried out in house (non-subcontract).

5.3 Degree of Process Intricacy

Since China's CI is a developing one, there are many problems in it, such as unsound regulation system, miscellaneous procedures of construction, Guanxi[58] (connection) implication, and so on. Process intricacy indicates how costly it is for the main contractor not to contract out the work, while procedure complexity or miscellaneous indicates the degree of need to negotiate with the local government for license, approvement document, and so on, say, for the plumbing, electrical and heating types of work, there are a lot of procedures for the contractors to take according to the regulation of local government. Thus, they have the willingness to handle these procedures expediently in order to faster the construction time. Accordingly, we can get the following proposition:

Hypothesis 3 (H3)

The more the process intricacy and procedure complexity of a construction activity is, the more likelihood of subcontracting this work.

[58] Another translation for 'Guanxi' is relationship, which has being paid more and more attention to its construct by researchers on Chinese management. Hui and Craen (1997) illustrate 'Guanxi' plays the role in defining the infrastructure of the Chinese society that China, and most Asian countries, have a collectivistic rather than an individualistic cultural value orientation. The 'Guanxi' issue will be discussed expressly in the following section 6.4.

5.4 Complexity of Specialisation

In the manufacturing industry, product complexity is considered as a primary factor in firms' decisions to outsource (Masten, 1984). How about CI? Construction projects require a large number of labour specialties such as carpenter, bricklayers, plumbers, pipe fitters, electricians, painters, roofers, and so on. These trades are different in qualities, work activities, training skill levels and assessed value in the labour market (Eccles, 1981). In construction, product (service) or activity complexity largely defines the degree of difficulty in specifying and monitoring the quality of subcontractors' works. Vining and Globerman (1999) indicated three determinants of complexity: (1) the uncertainty surrounding the contract (this effects both contracting parties equally) which raises the probability that bounded rationality will come into play (Williamson, 1985); (2) the potential for information asymmetry[59]; and (3) the probability that there will be externalities that will affect the firm's other activities. Also, high task complexity raises the probability of information asymmetry, because it implies specialised knowledge or assets whose characteristics are only initially known to subcontractors or other experts. Main contractors should be paid attention on it. Thus, the hypothesis will be:

Hypothesis 4 (H4)

When the degree of complexity or specialisation of products or activities becomes severe, subcontracting will be more desirable.

---

[59] Information asymmetry means the probability that one party to the contract will have information that the other party does not have (Vining and Globerman, 1999).

5.5 Variation of Work Quality

According to TCT, uncertainty[60] refers to the inherent incompleteness of contracts. Looking up construction risk management textbooks, we can find that lots of kinds of uncertainty, ambiguity or risk may appear in the construction process. The new business environment evolved around high-tech production and global competition, quality is vital to an industries operation. There is no exception for CI. In CI, quality is a critical issue, and one that is important in distinguishing competitors. The quality of products or services directly determines firms' profitability, market share and their ability to survive or develop (Lina and Johnson, 2004). Construction firms are extremely sensitive to quality effects, which are also related with their reputations. Hence, the concern of quality has been met in the China's CI all these years through attempting to adopt the principles of QM. When performance or quality cannot be assessed easily, using subcontract can be 'inefficient' and 'risky', because it is not known what to reward and how (Williamson, 1981), and the client or main contractor cannot know the quality of project until completion date or even later. By adopting 'inefficient' and 'risky' perspectives, we put forth:

Hypothesis 5 (H5)

The more variation and larger influence of quality will occur or difficult to assess, the more desirable for non-subcontract.

5.6 Degree of Impact of Subcontracting on a Project

Organisational decision makers have strong preferences for certainty, stability, and predictability in organisational life (Ang and Cummings, 1997). When main contractors concerning subcontracting decisions, the thing they care about most

[60] Uncertainty refers to the degree that decision makers in firms are able to accurately predict situations that affect the planning and adaptation of a transaction. This can include a variety of factors, such as demand for the product, changes in technology, and ability to effectively monitor performance of employees (Coles and Hesterly, 1998b).

should be how the subcontractors can do for them, and whether they could complete the subcontract work perfectly[61]. In practice, decision making is often hampered by uncertainty. As González-Díaz, Arruñada and Fernández (2000) argued, uncertainty has an ambiguous effect on VI decisions, depending on several factors[62]. Several studies have reported the results to support the notion that increases in uncertainty will result in a greater likelihood of VI (Anderson, 1985; Masten, 1984; Walker and Weber, 1984, 1987). For an experienced main contractor, before he/she makes a subcontracting decision, it is very important to think about whether there is any impact on the entire project, which may caused by subcontracting. For these reasons, we can propose the following hypothesis:

Hypothesis 6 (H6)

The larger impact of subcontracting on the project will be, in terms of cost, time, quality, and so on, the less likelihood to subcontract.

5.7 The Conditions of Local Subcontracting Markets

The condition of local subcontracting market is another affecting factor for subcontracting decisions. Such as the quality of the subcontractors, it is not only the quality of them own, but also influences the quality of the project. The more qualified they are, the more likely the main contractors contract out the projects to them.

The decision on whether to make in-house or contract out was also influenced by how competitive the market was for each contracted item. If the market was not very competitive, for example consisting of only a few suppliers or dominated by a single supplier, subcontracting could result in the company being over-dependent on the

[61] Williamson (1975) concludes that, in principle, a situation characterized by a high degree of uncertainty is best dealt with within the company, within a hierarchical structure.

[62] The importance of high-powered incentives to avoid opportunism; the correlation between the variability of subcontracted activities and the firm's main activity; and the interaction with specificity.

supplier[63]. Competition in suppliers' markets encouraging subcontracting is also proved by Ono and Stango (2005). For CI if some types of work are taken internally, they are not sold in competitive markets, and then the non-subcontract activities may be inefficient, because subcontracting might result in lower cost. The competitive effect may even make the costs of internal making higher than the costs of using subcontracting. Thus, greater subcontractor market competition in CI should lead to subcontracting.

Moreover, in TCE theory, information asymmetry means the probability that one party to the contract will have information that the other party does not have. A party possesses hidden information when it has knowledge about the conditions of demand, technology, or cost that other parties do not have and cannot learn (Besanko, et al. 2004). This means if the information of subcontractors is lack, the main contractors would be afraid to contract project out to them. From the above, we can infer that:

Hypothesis 7 (H7)

Large number of qualified subcontractors, information sufficiency of them, and cost implications will increase the likelihood of subcontracting.

5.8 Main Contractor's Experience

A person's decisions are influenced by even subtle changes in the task, the environment or their own personal perspective. These influences on human behaviour and the resulting decisions have been termed behavioural decision-making and been studied in psychology, economics, consumer behaviour and many other fields in the past 30 years (Mantel, et al. 2005). It also indicates that the experience of main contractors may cause information asymmetry. From another hard and soft system

[63] If the decision to subcontract resulted in the company no longer having the facilities or resources to make in-house it was likely to have very little bargaining power in negotiating future contracts (Tayles and Drury, 2001).

viewpoint in PM (Yeo, 1993), different main contractors may solve problems in different ways, even though they have the same background about technical training or body of knowledge in subcontracting, which means the main contractor's individual perception is also a significantly decisive factor of a successful subcontracting decision. Crawford and Costello (2003) increase understanding about this situation and point that it is necessary to engage with people at a qualitative level. People are seen as individuals, with their own culture and continually developing and refining their views of the real world situation in which they are taking action. Hence main contractor's experience and age for a kind of subcontract work may reduce the cost of production, so the hypothesis can be stated as follows:

Hypothesis 8 (H8)
Main contractor's degree of familiarity or experience and age for a kind of activity, increases the likelihood of a non-subcontract decision.

5.9 Frequency

Three commonly cited aspects of transactions are asset specificity, uncertainty and frequency. Frequency refers to the repetitiveness of similar transaction exchanges. Majumdar and Ramaswamy (1994) found that in industries in which goods are frequently purchased, the downstream distribution activities were more likely to be fully integrated. Jensen and Rothwell (1998) analysed the decision to rely on subcontractors or on in-house employees for undertaking some tasks in nuclear power plants. Their empirical results suggested that frequent tasks (routine maintenance, reactor operations, waste processing) were done by workers of the firm, while infrequently performed tasks (refuelling, special maintenance) were positively associated with the presence of independent contractors. In other words, frequency implies the uncertainty of volume, which leads to a making rather than buying decision. Thus, a hypothesis can be formulated as follows:

Hypothesis 9 (H9)

The more frequent contract occurs, the less likely activities will be subcontracted. Workload uncertainty leads to make rather than buy.

Table 5 summarises the hypotheses, and the expected sign of subcontracting decision.

Table 5. 1 Summary of Hypotheses

Hypothesis	Variable	Incidence on the Subcontracting Decision
H1	Asset Specificity	Negative (−)
H2	Degree of Firm's Competency	Negative (−)
H3	Degree of Process Intricacy	Positive (+)
H4	Complexity of Specialisation	Positive (+)
H5	Variation of Work Quality	Negative (−)
H6	Degree of Impact of Subcontracting on the Project	Negative (−)
H7	The Conditions of Local Subcontracting Markets	Positive (+)
H8	Main Contractor's Experience	Negative (−)
H9	Frequency	Negative (−)

Each hypothesis from 'H1' to 'H9' in Table 5.1 corresponds to each variable from 'V1' to 'V9' for the interviews.

Chapter 6. Discussion

6.1 Interview Results Analysis

The interviewed items were measured using a 10-point scale in which '1' represented "low degree" ("not important") and '10' represented "high degree" ("most important"). Thereby, the responded weightiness for each of the predictor variables indicated the variable's impact on the probability that the outcome would be subcontract or non-subcontract ("source in-house"). Five results from six responses were adoptable for further statistical calculation. The sixth interviewee's response was not given as the ten-point scale format, replaced by listing the key subcontracting considered factors[64] on their company's document which are used when they make subcontracting decisions in practice.

6.1.1 Results of Hypotheses Variables Evaluation

Table 6.1 presents the four interview results[65] after calculating mean values for each type of trade of the hypothetic variables. The Ratio column represents the percentage of subcontracting. In order to compare the different influence of the variables for the subcontract or non-subcontract decision, types of trades in Table 6.1 was divided into Group A (Subcontract Ratio >50%) and Group B (Subcontract Ratio <50%) to be shown.

[64] The sixth interviewee's response is shown in *Appendix 2* Table A2.5.
[65] Please refer to Appendix 2 for more detailed content of all the interviews' results.

Table 6. 1 Four Samples' Evaluation Result of Explanatory Variables

Type of Subcontracting		Measurement of Explanatory Variables for the Make-or-Buy Decision								
Type of Trade	Ratio (%)	V1	V2	V3	V4	V5	V6	V7	V8	V9
Group A — Subcontracting Ratio>50%										
Waterproof	>50%	4.5	4.25	4	7	5.5	6.75	5.75	5.25	4.5
Brickwork	>50%	3.5	3.5	2.75	2.75	4	6	4.25	6	3.75
Plastering	>50%	3.5	3.5	2.75	3	4.75	6	4.25	5.25	3.5
Flooring	>50%	4.5	5.25	3.75	7.5	4.75	5.25	4.25	5.5	3.75
Intelligent Building	>50%	6	6	6	8.25	5.5	6.75	6.25	6.75	3.25
Group A Variables mean		4.4	4.5	3.85	5.7	4.9	6.15	4.95	5.75	3.75
Group B —Subcontracting Ratio<50%										
Roofing	<50%	4.5	4.25	4	5	5.5	6	5.25	6.5	4
Tiling	<50%	4.5	5	4	6	4	5	4.25	6.25	3.25
Painting	<50%	4.5	5	2.75	7.75	5	5.75	4.25	6.25	3.5
Electrical	<50%	5.75	5.25	6	6	6.25	8	4.5	6.5	3
Plumbing	<50%	5.75	5.25	6	6	6.25	7.75	4.5	6.25	2.75
Heating & cooling	<50%	5.75	5.25	6	6	6.25	7.75	4.5	6.25	2.75
Group B Variables mean		5.25	5.15	4.95	6.35	5.55	6.85	4.4	6.3	3.05
Total Variables mean		**4.8**	**4.77**	**4.36**	**5.93**	**5.25**	**6.45**	**4.73**	**6.07**	**3.45**

The interview data show how influencing importance of factors affect the subcontracting decisions. In general, the results reflect the influence of the hypothetic variables at a certain extent. According to Table 6.1, descriptive statistics summary of each variable, including the means, standard deviations, min and max, is shown in Table 6.2.

Table 6. 2 Summary of Descriptive Statistics of Variables

Summary of Descriptive Statistics of Variables*				
Variable	**Mean Value**	**Std. Dev**	**Min**	**Max**
V1	4.80	3.45	1.27	8.36
V2	4.77	4.05	1.00	10.00
V3	4.36	2.76	1.09	7.45
V4	5.93	2.51	2.64	8.27
V5	5.25	3.09	1.18	8.18
V6	6.45	2.01	4.18	8.64
V7	4.73	4.11	1.18	10.00
V8	6.07	3.85	1.09	10.00
V9	3.45	2.82	1.00	6.82

* Base year is 2005

Table 6.3 provides correlation statistics of all these variables.

Table 6. 3 Correlation of Explanatory Variables

Correlation Coefficients Matrix of Explanatory Variables									
	V1	*V2*	*V3*	*V4*	*V5*	*V6*	*V7*	*V8*	*V9*
V1	1								
V2	0.870732	1							
V3	0.952568	0.733955	1						
V4	0.617385	0.834181	0.404069	1					
V5	0.793313	0.474579	0.792262	0.333479	1				
V6	0.709255	0.307118	0.781782	0.06613	0.885788	1			
V7	0.380457	0.269976	0.368106	0.427261	0.322004	0.223153	1		
V8	0.633109	0.578266	0.557642	0.264612	0.322971	0.301989	0.212723	1	
V9	-0.62416	-0.54255	-0.63262	-0.056	-0.4093	-0.50421	0.330251	-0.53458	1

It is notable that the correlations between asset specificity and firm's competency, asset specificity and process intricacy, firm's competency and specialisation, variation of work quality and impact on the project are all positive and significant, while frequency and conditions of subcontracting markets do not have a significant

correlation with the other variables.

Since SUCG is mainly engaged in non-building construction sectors in Shanghai, the data come from it cannot be combined with other firms'. Therefore, the results from SUCG were calculated separately as shown in Table 6.4.

Table 6. 4 SUCG's Evaluation Result of Explanatory Variables

Type of Subcontracting				Measurement of Explanatory Variables for the Make-or-Buy Decision								
Category	Type of Work	Type of Trade	Ratio (%)	V1	V2	V3	V4	V5	V6	V7	V8	V9
1	**Foundation**	Piling	<50%	8	5	4	2	2	2	5	5	5
2	**Drywall Frames**	Depress Water Line	>50%	5	4	4	7	5	7	7	6	4
		Digging	>50%	4	3	3	4	3	8	8	7	3
		Reinforcing	>50%	7	7	6	8	7	7	8	6	5
3	**Framework**	Reinforcing Steel	<50%	2	2	2	2	3	5	8	7	3
		Concrete	<50%	4	3	2	2	3	6	7	6	3
		Bracket	<50%	5	3	3	2	3	5	7	7	3
		Moulding	<50%	5	3	3	2	2	5	7	7	2
Variables mean				5	3.75	3.38	3.63	3.5	5.63	7.13	6.38	3.5

For better analysing the affecting of these variables, compare and contrast these four groups of importance evaluation is an applicable approach, as following Table 6.5.

Table 6. 5 Comparison of the Mean Value of Variables

Mean Value of Explanatory Variables									
Sample	V1	V2	V3	V4	V5	V6	V7	V8	V9
Group A+B	4.80	4.77	4.36	5.93	5.25	6.45	4.73	6.07	3.45
Group A	4.4	4.5	3.85	5.7	4.9	6.15	4.95	5.75	3.75
Group B	5.25	5.15	4.95	6.35	5.55	6.85	4.4	6.3	3.05
SUCG	5	3.75	3.38	3.63	3.5	5.63	7.13	6.38	3.5

Table 6.5 shows the comparison of the above mean values of explanatory variables. We can easily find how important the factors affecting decisions. Due to the particular

municipal type projects of SUCG (i.e. underground, metro and track traffic projects, sewerage treatment projects, trans-river tunnel projects, etc. non-building construction sectors), its result has some dissimilarity with other samples, which are mainly focus on building construction sectors. That is the reason why its result is listed separately.

From the comparison, we can see that for Group A, Group B and Group A+B, the affected weightiness of these nine factors is more or less the same. For SUCG, however, the results show that the factor 'The Conditions of Local Subcontracting Markets' is quite important than other variables, it is due to the special projects of them. Since SUCG is engaged in metro and track traffic and tunnel projects, the requirement for the quality and security is severely high. Therefore, the subcontractors' quality and the familiarity of them are very important factors for subcontracting decision. The characteristics of their projects also cause the variation of work quality is a less important factor, because evaluating of performance or quality is easy for them. Furthermore, the factor of 'Degree of Process Intricacy' is less important than other samples' results, it is because they do most of the work for government, so the procedures during construction are easier and more efficient for them.

6.1.2 Results of Eccles' Seven Reasons Evaluation

Pursuing the importance changing of subcontracting reasons identified in the reviewed literature, especially in China's CI, the following section presents the findings from interviews examining the reasons[66] for subcontracting, based on the different types of trades that have been classified in Table 4.4.

Table 6.6 and 6.7 present the interview results for the evaluation of Eccles' (1981) seven subcontracting reasons.

[66] As shown in Table 4.3.

Table 6. 6 Four Samples' Evaluation Result of Eccles' 7 Reasons

Type of Subcontracting	Weightiness Evaluation of Eccles' Seven Reasons for Subcontracting						
Type of Trade	**R1**	**R2**	**R3**	**R4**	**R5**	**R6**	**R7**
Roofing	5.25	7.25	4.5	6	6.25	5.5	2.75
Waterproof	5.25	7.25	4.5	6	6.25	5.5	2.75
Brickwork	6.5	8.5	5	5.25	4.25	4.5	1.25
Plastering	4.75	6.5	5.5	5	4	3.5	1.5
Tiling	6	6.5	5	5.25	4.75	3.25	1.5
Painting	5.75	6.75	5	5.25	4.5	3.5	1.5
Flooring	5.5	6.5	5	5.25	4.75	3.5	1.5
Electrical	6	6.25	4.25	5.5	5.25	5.5	3.75
Plumbing	6	6.25	4.25	5.5	5.25	5.5	3.75
Heating & cooling	6	6.25	4.25	5.5	5.25	5.5	3.75
Intelligent Building	4.75	6	4.25	6	5.25	6.25	5.75
Mean Value	5.61	6.73	4.68	5.5	5.07	4.73	2.7

Table 6. 7 SUCG's Evaluation Result of Eccles' 7 Reasons

Type of Subcontracting	Weightiness Evaluation of Eccles' Seven Reasons for Subcontracting						
Type of Trade	**R1**	**R2**	**R3**	**R4**	**R5**	**R6**	**R7**
Piling	3	3	8	5	8	5	5
Depress Water Line	3	3	5	5	8	5	5
Digging	7	7	5	5	7	7	7
Reinforcing	6	6	6	4	8	5	7
Reinforcing Steel	8	8	10	5	4	5	5
Concrete	4	4	10	5	3	7	5
Bracket	3	3	10	5	5	5	5
Moulding	6	6	9	5	6	5	5
Mean Value	5.00	5.00	7.88	4.88	6.13	5.50	5.50

From Table 6.6, we can rank Eccles' seven reasons again, shown in Table 6.8.

Table 6. 8 New Ranking of Eccles' Seven Reasons

New Ranking of Eccles' Seven Reasons			
Rank	**Reason**		**Value**
1	R2	Lower construction costs	6.73
2	R1	Keep overhead costs low	5.61
3	R4	Supervision problems	5.50
4	R5	Keep equipment investment cost low	5.07
5	R6	Volatility in workload	4.73
6	R3	Insufficient amount of work	4.68
7	R7	Miscellaneous	2.70

As shown in Table 6.8, we can find that compare with Eccles' ranking, the new ranking is different at R2, R1 and R3. Actually, in Eccles' survey, the responses for why subcontracting was adopted for R1 and R2 did not have too much difference. The percentage of responding 'keep overhead costs low' was 29.6%, and the percentage of responding 'lower construction costs' was 26.6%. Therefore, we can say that they are the two most important reasons. For the reason of 'insufficient amount of work', there is a reasonable explanation in terms of the current circumstance of China's CI. A truth we all know is that China is one of the largest population countries in the world. As Flanagan and Li (1997) described, China's CI is vast, arguably the biggest in the world. As the CI sector employs more people than any other, statistics have shown that at the end of 1992, there were 27 million people employed in the Chinese CI; this is 4.5% of the total labour force in China (Cheng, 1994). Advantageously, labour-intensive industry provides huge employment opportunities for the community. Thus, insufficient amount of work is not a serious problem in China's CI.

6.2 Testing of Hypotheses

This section aims to explain how to verify hypotheses listed in Chapter 5. Due to the small sample size, the popular technique—probit or logit regression model[67] is not suitable. Instead, we use mean value comparison. The ranking of the relative importance of each variable in two groups was given in Table 6.9.

[67] Probit and logit regression are nonlinear regression models specifically designed for binary dependent variables (Stock and Watson, 2003: 302-309).

Table 6. 9 Ranking of the Decision Factors for Different Groups

Variables Ranking for Different Groups								
Rank	Mean Value for all Trades		Group A		Group B		Shanghai Urban Construction Group (SUCG)	
	Variable	Value	Variable	Value	Variable	Value	Variable	Value
1	V6	6.45	V6	6.15	V6	6.85	V7	7.13
2	V8	6.07	V8	5.75	V4	6.35	V8	6.38
3	V4	5.93	V4	5.7	V8	6.3	V6	5.63
4	V5	5.25	V7	4.95	V5	5.55	V1	5.00
5	V1	4.80	V5	4.9	V1	5.25	V2	3.75
6	V2	4.77	V2	4.5	V2	5.15	V4	3.63
7	V7	4.73	V1	4.4	V3	4.95	V5	3.50
8	V3	4.36	V3	3.85	V7	4.4	V9	3.50
9	V9	3.45	V9	3.75	V9	3.05	V3	3.38

From Figure 6.1, we can see the importance of different variables. The same as before, we just focus on the results of the first three groups. The results indicate that the hypotheses tested in this analysis all reflect an underlying assumption that they are the main influencing factors of subcontracting decisions.

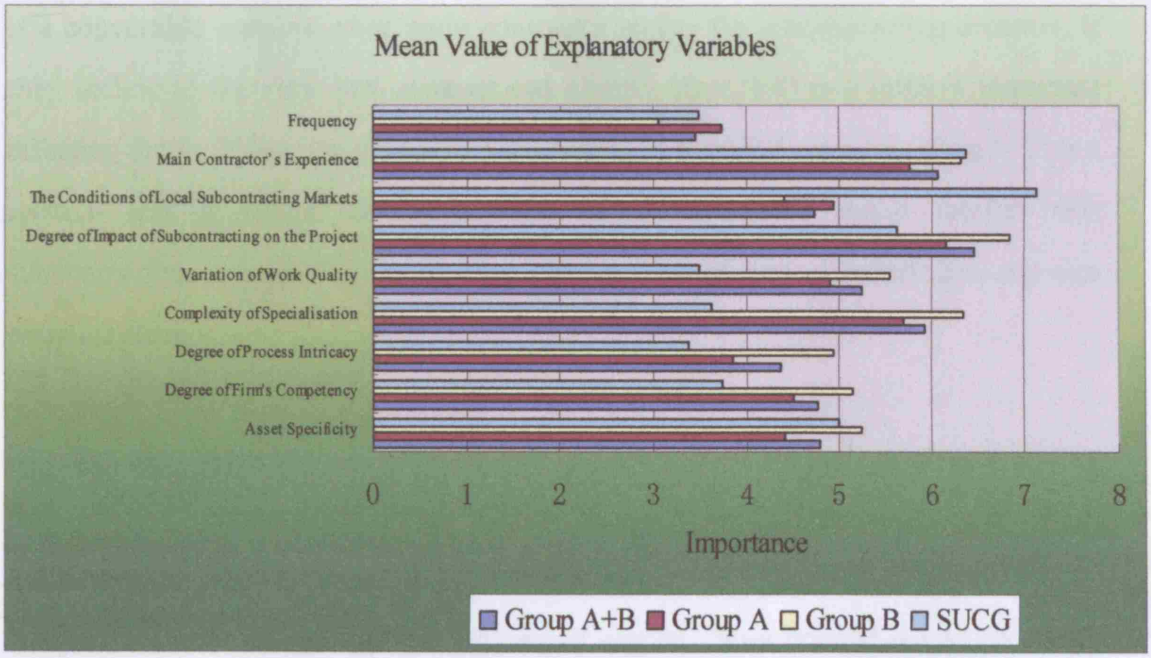


Figure 6. 1 The Importance of Explanatory Variables

The interview data suggests that, for all the samples' result, 'V6' ('Degree of Impact of Subcontracting on the Project'), 'V8' ('Main Contractor's Experience'), 'V4' ('Complexity of Specialisation') ranked as the three most important factors affecting the decision of subcontracting. All the interviewees thought the impact of subcontracting on the project is a quite serious problem when they are making the subcontract decisions. On the other hand, 'V3' ('Degree of Process Intricacy') and 'V9' ('Frequency') are the least important factors affecting the decision of subcontracting.

Moreover, since Group A represents the activities that outsource ratio more than 50%, and Group B represents the activities that outsource ratio less than 50%, the different of ranking between them can indicate the variable's influencing weightiness for subcontract or non-subcontract decisions. If we carefully compare the ranking of Group A and Group B, we can find that the position of 'V7' ('The Conditions of Local Subcontracting Markets') has greatest change. This result indicates that for subcontracting trades, the influence of the condition of local subcontractors is greater to the decision making than for non-subcontracting trades. Thus, we can say that 'V7' is a convertible variable when main contractor makes the subcontracting decision. If they incline to the view that contract out a trade, than 'V7' is a relative important affecting factor. If they incline to the view that does a work themselves, than 'V7' is a relative less important affecting factor. This remarkable result implies that subcontracting is probably driven by a combination of factors rather than any one simple influence.

The data also suggests that 'V2' ('Degree of Firm's Competency') has less influence than 'V5' ('Variation of Work Quality') and 'V6' ('Degree of Impact of Subcontracting on the Project'), which can also be proved by Mantel's et al. (2005) study of the behavioural decision-making of human. They pointed out of the many personal characteristics that can influence the decision process; one issue especially

relevant to the supply chain decision-making context is the perception of importance[68]. Although one might hope to increase the accuracy of the judgment if a feeling of importance, this motivation to process the decision does not appear to be sufficient because decision maker tries harder, but continues to use the decision processing strategy dictated by other elements in the situation[69]. When these findings are adapted to the make-buy decision, this would suggest that, while importance (e.g., firm's competency) will influence the decision, other factors (e.g., variation, risk) might have a greater influence.

As suggested in the interview data, all the above outcome looks logical, except for the least important variable—'Frequency'. It is extremely unusual, because frequency is one of the three most commonly cited aspects of TCT. Just as Walker and Weber (1984) argued that both volume uncertainty and supplier market competition have small but significant effects. After carefully and detailed consideration, the reasonable explanation was given out. Before commentating this, however, let us have a look at the reason why 'Degree of Process Intricacy' is not a relevant important for the above analysis quickly.

As we know, all these data come from five Chinese first-tier construction companies, and which are all state-owned. Therefore, they would be quite familiar with the government department. It cannot deny bureaucracy and bribery are still prevalent in China despite the recent efforts made by government to eradicate these ills. The testing and commissioning process for a construction project is often not serious enough. For example, connections at the right places, kickbacks, and so on, all these

[68] When a decision maker feels that the judgment is important they tend to become more involved in the decision process. Intuitively, one might expect that a feeling of importance or involvement in the decision would increase the accuracy of the judgment (Mantel, et al. 2005).

[69] It has been shown that individuals spend more time considering and evaluating an important decision; however, this motivation to process the decision does not appear to be sufficient by itself to increase judgmental accuracy because the decision maker tries harder, but continues to use the decision processing strategy dictated by other elements in the situation (Mantel, et al. 2005).

would help the first-tier contractors to establish good relationships[70] with the construction departments. As a result, the certification, authorization or approval of construction can be obtained easily from the construction department through simple and convenient procedure. That is why they think the process intricacy and procedure complexity is not a difficulty for them. Strictly speaking, I also cannot deny the probability of administrative monopoly and local protectionism[71] still happens somewhere. In Walker's (1995) book, he mentioned that there is also still a protectionist attitude in China and competition between companies in different regions or even adjacent towns is often not allowed, but these attitudes are breaking down.

The non-significant effect of another moderator—'Frequency' on decision making influences from the data analysis suggests that for these top Chinese construction corporations, the workload frequency is not an important problem, which indicates the construction volume is not greatly fluctuant. Mainly, besides the reason the data of these firms was focused on building type construction that the activities have few varieties and fixed, there are another three reasons. In order to explain these reasons, we need to recall the general overview of China's CI in Chapter 2 and followed by deeper investigation.

Firstly, China's CI is one of the industries deeply influenced by the planned economic system. There was a long period during which the legality of the CI to make a profit was denied in China. Under the regionalisation schemes, China's provinces are used as the basic units[72]. From the data in Footnote 72, we can easily find that the

[70] This may also relate to cross-cultural discussion in section 6.4.

[71] Local protectionism, to a great extent, is a form of administrative monopoly. Generally, the more underdeveloped the regions, the more serious the local protectionism. Administrative monopoly has become the biggest institutional bottleneck restricting the development of the construction market (Sha, 2004).

[72] They range in geographical area from 5000km2 (Shanghai) to 1.6 millionkm2 (Xinjiang). Their populations were between 2.62 million (Tibet) and 92.5 million (Henan) in the 2001 census. The provincial GDP per capita was between 2818 RMB yuan (Guizhou) and 27,187 RMB yuan (Shanghai) (US$1.00=8.3 RMB yuan) in 2000. Moreover, the size of the construction industries in the provinces in 2000 ranged from 1.7 billion RMB yuan in Tibet to 154 billion RMB yuan in Jiangsu (Ofori and Han, 2003).

development is very imbalance between different provinces. There are 31 provincial administrative units in China. These include four municipalities (Beijing, Shanghai, Tianjin and Chongqing), directly administered by the central government; five autonomous regions (Neimenggu, Guangxi, Tibet, Ningxa, and Xinjiang); and 22 "ordinary" provinces[73].

For historical reasons, China's coastal region[74] (the eastern region) has been more developed than the non-coastal region (i.e., the central and western regions), with a relatively advanced manufacturing sector, more trade, and a better-educated workforce. Renewed emphasis on the development of the western region began in the mid-1990s (Ofori and Han, 2003). Logically accordant, all these interviewed first-tier firms are located in the eastern region. The city development of Beijing, Shanghai, Tianjin is steady, which implies the construction in these cities tends to rational, designable, and smooth.

If anyone should confuse with how the regionalisation scheme could affect the construction frequencies (volume) in these cities, they can do no better than to refer to the relationship between CI and economic development in China's provinces. Ofori and Han (2003) studied the relationship between construction and the economy in the development of China's provinces by applying the indicators of the levels of development of the various provinces to examine differences in: construction value added (VA); contribution of construction to GDP; annual growth rate of construction VA; mix of construction output; contribution of construction to overall employment; and levels of technology used in the industry[75]. Table 6.10 and 6.11 present the GDP

[73] Please refer to *Appendix 4* Figure A4.1 China's provinces and the three regions.

[74] The way regions are defined in China changes over time, depending on the prevailing central government development policies. Regionalisation schemes cited in the literature include the "coastal" versus "non-coastal" division; the "eastern", "central" and "western" division; and the northeast, northwest, southwest, central, north, and south division (Ofori and Han, 2003).

[75] The analysis was undertaken for the period 1990–2000 but for brevity, the tables present statistics and patterns for selected years.

value[76] and construction VA[77] of three interviewed cities from 1990 to 2000.

Table 6. 10 Beijing, Shanghai, Tianjin GDP values[78]

Provincial GDP values, 1990–2000 (in 100 million RMB yuan)						
Eastern provinces	**1990**	**1992**	**1994**	**1996**	**1998**	**2000**
Beijing	500.82	709.1	1084.03	1615.73	2009.9	2478.76
Tianjin	310.95	411.24	725.14	1102.4	1340.7	1639.36
Shanghai	744.67	1114.32	1971.92	2902.2	3688.2	4551.15

Table 6. 11 Beijing, Shanghai, Tianjin construction VA[79]

Provincial variations in construction VA, 1991–2000 (in 100 million RMB yuan)						
Eastern provinces	**1990**	**1992**	**1994**	**1996**	**1998**	**2000**
Beijing	35.94	52.94	94.73	141.73	176.8	198.19
Tianjin	16.85	20.61	42.81	57.36	71.9	72.89
Shanghai	35.85	40.71	79.93	143.36	200.5	207.02

Figure 6. 2 Beijing, Shanghai, Tianjin GDP values 1990-2000

[76] Please refer to *Appendix 4* Table A4.1 for the entire table of the Chinese provincial GDP values and descriptive statistics.

[77] Please refer to *Appendix 4* Table A4.2 for the entire table of the Chinese provincial variations in construction value added and descriptive statistics.

[78] Source: Adapted from Ofori and Han (2003).

[79] Source: Adapted from Ofori and Han (2003).

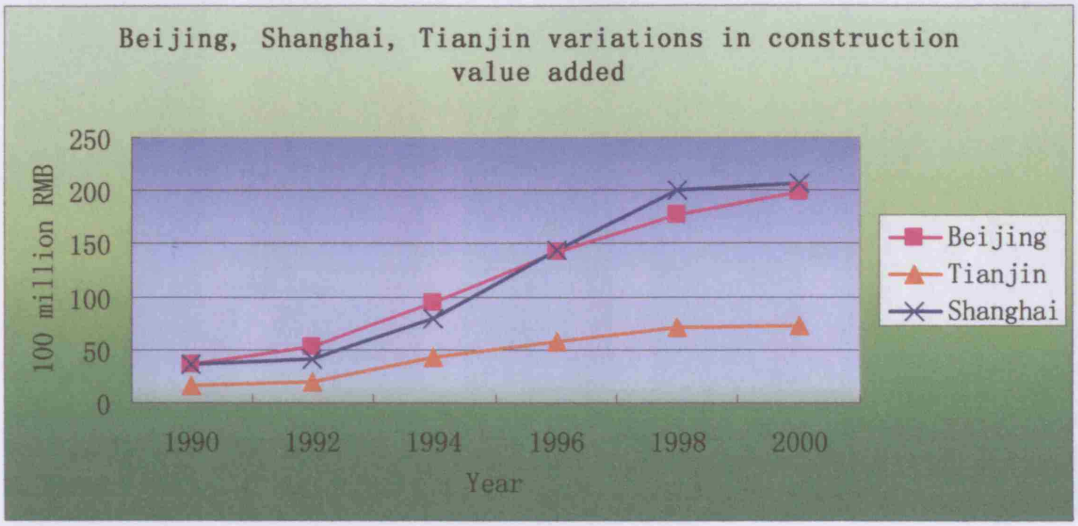


Figure 6. 3 Beijing, Shanghai, Tianjin variations in construction VA

From Figure 6.2 we can see that the GDP development of these three cities increased progressively and steadily. There is no fluctuation in these ten years. VA in construction indicates the size of the CI's direct contribution to the economy. Figure 6.3 shows that from 1998, these three cities' VA increase almost stop, which can prove why the construction volume is steady very well.

Alternatively, we can also analyse the annual growth rate[80] of construction VA from 1990 to 2000.

Table 6. 12 Beijing, Shanghai, Tianjin growth rate of construction VA

Provincial variations in growth of construction value added, 1991–2000 (in %)					
Eastern provinces	**91/92**	**92/94**	**94/96**	**96/98**	**98/2000**
Beijing	47.3	33.77	22.32	11.69	5.88
Tianjin	22.31	44.12	15.75	11.96	0.69
Shanghai	13.56	40.12	33.92	18.26	1.61

[80] Please refer to *Appendix 4* Table A4.3 for the entire table of the Chinese provincial variations in growth of construction value added and descriptive statistics.

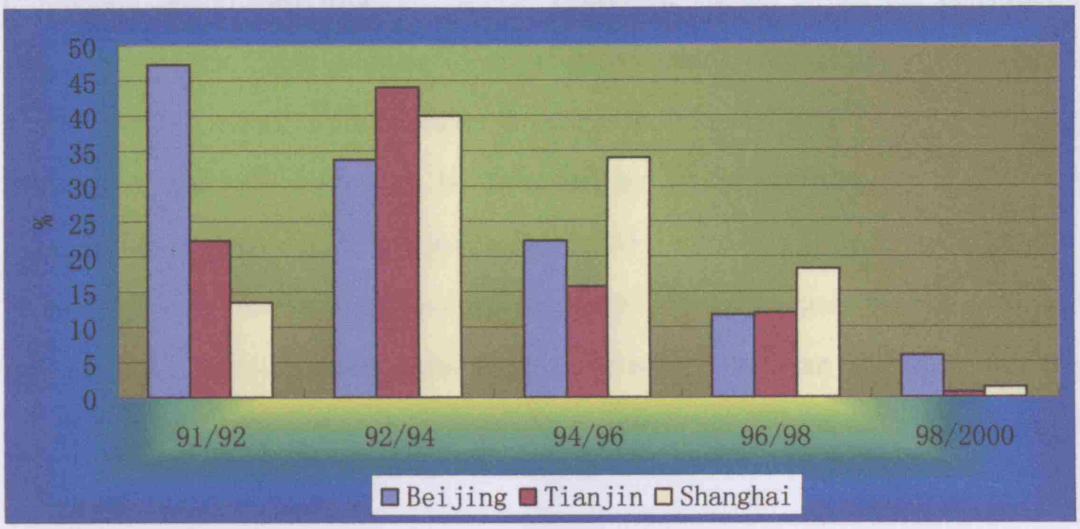


Figure 6. 4 Beijing, Shanghai, Tianjin variations in growth of construction VA

Table 6.12 and Figure 6.4 suggest that the growth rates for these three cities declined consistently from 1992. Until 2000, the growth rate is only 5.88% for Beijing, and the growth rate of Tianjin is almost zero.

The confused contracting for public works is another reason besides the regions aspect. In spite of there are Tendering and Bidding Law and the repeated injunctions of Chinese government, both the owners of public projects (some of whom are local government departments) and the contractors evade public and competitive tendering by every possible means. In 2000, the proportion of the projects that used public tendering compared with total public projects was 67%. However, most were tendered and bid as a mere formality. A special investigation on government funded projects revealed that only 10% of these projects were really contracted in accordance with the Tendering and Bidding Law, i.e. on a competitive basis (Sha, 2004). This can also illuminate the result otherwise why the first-tier construction firms in China always get sufficient contracts.

Reputation should be the third reason. Reputation can have a powerful impact on opportunistic behaviour, because protection from opportunism is costly, trustworthy firms are attractive transaction partners. Firm reputation can thus influence a

transaction governance structure choice. Currently, almost all of the construction firms operating in China are state-owned organisations. Competition for the award of a construction contract is not based on the prices they submit, because the state sets up a standard unit rate system to be followed by all construction firms for every construction project in the country (Cheng, 1994). Under this system, the only means of subcontractors to convince developers to award them the construction contract is through the quality of past construction projects[81]. We can say that the good reputations made these first-tier construction enterprises always have chance to get big projects.

6.3 Model of Hypotheses

From the above analysis, we know that the "make-or-buy" decision considerations of CI should not only focus on costs, especially in China that there are many points that must be considered before decision. Moreover, Figure 6.5 presents an assessing model of subcontracting decision making factors on the basis of the above analysis.

The assessing model suggests what the important factors are to make subcontract or non-subcontract decisions in China's CI. The factors on the left side of the mid-arrow all have a positive influence for the subcontracting decision. The factors on the other side have a negative influence for the subcontracting decision. The mid-arrow from '0' to '10' indicates the significance of these factors based on the above analysis. Therefore, main contractors can make the subcontracting decisions by overall considering the significance of these factors.

[81] It is an advantage for QM that can drive contractors to improve quality in return for the award.

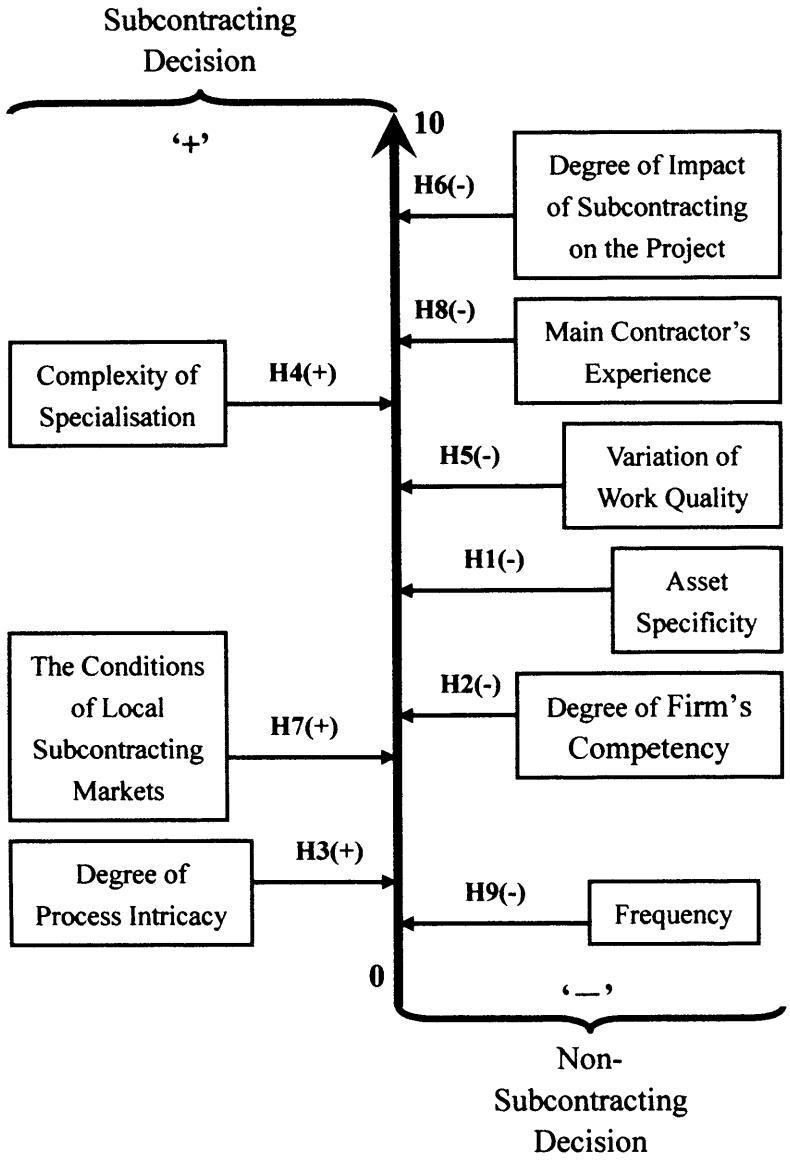


Figure 6. 5 Assessing Model of Subcontracting Decision Making Factors

6.4 Cross-Cultural Discussion of Guanxi Concept

In this section, another important issue for the subcontracting decision in China's CI will be pointed out. In CI, if a firm chooses to obtain certain inputs from other firms it faces the question of how to manage these relationships (Eccles, 1981). By the same token, the subcontracting practice in China's CI is also influenced by the relationship between people. Jenkins (2002) explains China's cultural tradition encapsulates the

three chiao (angle) of Confucianism[82], Taoism and Buddhism, and one of the most influences for Chinese in their society is Confucianism nowadays[83], which also has much related with the subcontracting practices in China's CI. Under the influence of Confucianism, the Chinese often emphasise the attributes of friendship, mutual interests and the importance of mutual trust that Guanxi[84] (connection) is a very important concept in China. Guanxi can be more important than morality in China and contributes to a tendency to be more person than problem solving focused in organisations (Hui and Craen, 1997). This can also explain the serious problems exist in project tendering and subcontracting field in current CI. In China, construction projects in many places are given to closely-related units randomly without public competitive tendering, and for the subcontracting practices, the main contractors make the decision only according to their relationships with the subcontractors[85].

From a more humanistic perspective, the organisational culture could reflect the national culture in strong forms. For example, this may affect the upstream or downstream of the supply chain in CI due to the trust and respect. This means main contractors or clients may make the subcontracting decision ignoring TCE, long-term profits or even the cost reduction. Chen and Partington (2004) have explored some apparent areas of difference between Chinese and Western cultures which can help improve understanding the characteristics of Chinese culture (shown in Table 6.15). This is another reason why there is a hypothesis H3 'Degree of Process Intricacy' as an affecting factor in subcontracting practice in China's CI.

---

[82] Confucius (K'ung Fu-tzu, 552–479 BC) disseminated a philosophy of harmonious social relations, moral standards and ethical behaviour in public life. His colossal influence in China and elsewhere in East Asia was aided by later disciples including Mencius (Meng-tzu, 374–289 BC) and Hsün-tzu (298–238 BC) (Jenkins, 2002).

[83] Strictly speaking, Confucianism is not a religion, but rather an ethical system which relies on both scholarship and speculative thought to guide social behaviour (Martinsons and Westwood, 1997).

[84] Please refer to Footnote 58.

[85] If some one doubts about this, it is no better than to refer to *Appendix 2* Table A2.5 'The Response of the Sixth Interviewee'. According to this ranking, which ranked fifth, some social factors (i.e. the relationship between client, government, main contractors, and subcontractors) may account for 30% of influence when making the subcontracting decisions.

Table 6. 13 Important dimensional differences between Chinese and Western cultures[86]

Chinese Culture	Western Culture (UK & USA)
Collectivism	Individualism
Large power distance	Small power distance
Strong uncertainty avoidance	Weak uncertainty avoidance
Long-term orientation	Short-term orientation
Outer-directed	Inner-directed
Relationship	Contractual
Conservatism, tension between hierarchy and harmony	Autonomy, tension between mastery and egalitarian commitment/harmony

In addition, Confucianism also affects the legislation of China's CI. For example, most of the ordinances issued by the national government are only a legal framework. This is to allow the local government and officials, who are assumed to have a high moral and ethical standard, more room to explain and interpret the ordinances (Chan, Wong and Scott, 1999). Thus, some contractors utilise this leak to dismember subcontracting a project or pass on to unqualified subcontractors without considering the legal restraint.

[86] Source: Adapted from Chen and Partington (2004).

Chapter 7. Limitations of the study

The fact that the empirical results confirm many of the hypotheses and are consistent with previous empirical studies is encouraging. Still, my choice of empirical setting raises some theoretical and methodological issues that there are several limitations associated with this research, particularly the sample size, survey snapshot, and personal characteristic.

First of all, the small sample size and the fact that the data were drawn from a few corporations limit the universality of the findings. Thus, if there is more time, examining the other top Chinese construction firms to widen the sample size and try best to interview more experienced main contractors should be considered.

Moreover, at the time of examination, construction as an industry and activity was changing rapidly. Managers were actively shifting boundaries and changing the nature of their activities. This setting is considerably different from the rather stable industries and settings, which characterise most studies of make-or-buy decisions (Poppo and Zenger, 1998). Therefore, another limitation of this study is that the data from the survey exhibit a snapshot at a certain time. Providing additional longitudinal analysis of the construction firms under study should be adoptable.

Finally, the use of perceptual data drawn from single respondent represents another possible limitation. In principle, if there are lots of alternative choices of measures, objective variables are the first priority, subjective direct measure is the next, and the last one is subjective indirect measure. It indicates that personal characteristics cause the collected data within some main contractors' subjective factors in the study. Thereby, in order to avoid the influence of subjective factors, I should choose the main contractors or professionals as experienced as possible, and before they

evaluating the variables, there would be a pre-sessional phase, like training, to explain each variable's meaning and the level for each point. Although I did all these kinds of preparation, the results of individual diversity are still cannot be avoided.

Chapter 8. Conclusions and Recommendations

8.1 Summary and Conclusions

This paper based on the conceptual frameworks of TCE and make-or-buy decision, deepened and broadened into the subcontracting practices of China's CI. Although there has been much study about make-or-buy decision, applying TCE into subcontracting practices of CI is the first time. It has studied what the key concerned factors are to influence the "source in-house" (non-subcontract) or "outsourcing" (subcontract) decisions for types of subcontract work, attempting to give a rational interpretation for the key concerned decision making factors of subcontract practice in China's CI. An evaluation of Eccles' seven subcontracting reasons was also made here to test its application in China's CI. In order to do these, a summary of some preliminary findings from previous studies enabling the way that the variables associated with make-or-buy decision are measured in the TCE literature was provided. Moreover, I have conducted interviews with six main contractors in China's CI to certify what they think about the subcontracting decisions, and in Appendix 2 of the report, I will attach the full results of the interviews.

The study found that make-or-buy decisions of subcontracting in China's CI are treated in various ways. They are affected by the level of assets specificity, degree of firm's competency, degree of process intricacy, complexity of specialisation, variation of work quality, degree of impact of subcontracting on the project, the conditions of local subcontracting markets, buyer's (main contractor's) experience and frequency of work. Therefore, the "make-or-buy" is a strategic decision that has implications for the overall corporate strategy of the construction firm, by analysing a number of strategic factors like those aforementioned. According to the data analysis, for the testing of Eccles' seven reasons, we found that 'insufficient amount of work' is a less

important reason in China's CI, duo to the large number of people employed in the China's CI. For the testing of the hypotheses, we found 'Degree of Impact of Subcontracting on the Project', 'Main Contractor's Experience' and 'Complexity of Specialisation' are the three most important factors affecting the decision of subcontracting in China. All those interviewed thought the impact of subcontracting on the project is quite a serious problem when they were making the subcontract decisions. On the other hand, 'Degree of Process Intricacy' and 'Frequency' are the least important factors affecting the decision of subcontracting. The latter results are mainly due to all these data acquired from five State Owned Chinese first-tier construction companies. For the process intricacy, since they should be quite familiar with the government department, and the probability of administrative monopoly and local protectionism induced that this factor is a less important one. For the frequency factor, there are three main reasons. First, the regionalisation schemes in China, the CI development in Beijing, Shanghai, and Tianjin is steady increasing and non-fluctuation; second, the confused contracting for public works; third, the reputation of these enterprises. All the above imply the construction volume is consistently smooth in them.

Moreover, the data also suggests that 'Degree of Firm's Competency' has less influence than 'Variation of Work Quality' and 'Impact of Subcontracting on the Project'. 'The Conditions of Local Subcontracting Markets' is a convertible variable when main contractor makes the subcontracting decision. If main contractors are inclined to the view that contracting out a trade, then it is a relatively important factor affecting decision. If they incline to the view that non-subcontract, than it is a relatively less important affecting factor. This remarkable result implies that subcontracting is probably driven by a combination of factors rather than any one simple influence. Further more, it is notable that the correlations between the asset specificity and firm's competency, asset specificity and process intricacy, firm's competency and specialisation, variation of work quality and impact on the project are all positive and significant, while frequency and conditions of local subcontracting

markets do not have a significant correlation with the other variables.

On the basis of the above analysis, an assessing model of subcontracting decision making factors was given at the end of the discussion, according to which, main contractors can make more correctly subcontracting decisions by overall consideration of the significance of each factor. Furthermore, this paper also presented the cross-cultural discussion of 'Guanxi' concept to illustrate its impact on subcontract decision-making.

8.2 Recommendations for Subcontracting in China

In the current CI market it is an important business strategy to minimise fixed costs and maximise flexibility. Subcontracting can therefore help to finance the project as the stage payment systems means that production generates a multiple income flow of cash and other forms of payment agreements. This is usually beneficial for both main contractor and subcontractor as the cash transaction is steady and consistent. Subcontracting has increasing in China's CI and is unlikely to decline because of its foreseeable benefits. Within China's CI, the decisions of subcontracting must get rid of the influence of undue relationships or astriction of feelings induced from Chinese Confucianism. The main contractors should not only consider minimising cost when they make subcontracting decisions, they should also be concerned with other factors, like degree of impact of subcontracting on the project, complexity of specialisation, their experience and so on. In this way, their firms would be efficient and more consistent in their long term business cycle enabling more profit. Moreover, a righteous legislation of China's CI should be established by the government imperatively. This would enable a movement up the hierarchy to an aggregate countrywide appreciation of subcontracting in China's CI, which would achieve a more robust and sustainable development.

8.3 Implications for Further Research

This study aimed to understand the influencing factors in "source in-house" or "outsource" decision-making of subcontracting practices in China's CI and, to that end, applying TCE to this area has not been done before. Future research should consider items with different characteristics including new measures. When analysing variables, considering some possible combinations of two or three characteristics could be a better way[87] to analyse objectives.

If there is enough time to collect more samples of data, the statistical regression model—logit or probit model could be applied to corroborate the statistical relation between the probabilities of making-or-buying each subcontracting trade and the attributes of transaction. Utilising the model, the main contractor has two alternatives: subcontract and non-subcontract which represent dependent variable, and measurement variables are independent variables, identified as critical in affecting the main contractor's choice.

Furthermore, consider to construct a model to evaluate the subcontracting decisions in CI. In other words, the model can bring forward an optimized combination of subcontracting chosen. It will be beneficial for all of the clients, main contractors, governments, even subcontractors. Consequently, a system can be designed to help main contractors in the subcontracting make-or-buy decision. Main contractors can utilise this kind of Subcontracting Variable Evaluation System (SVES) to decide whether to contract out the tasks or not according to different projects' demand, even can choose the most appropriate subcontractors.

Since the time is lacking for doing quantitive interviews, the information reported in Chapter 5 is done using six interviews of the Top-Ten Chinese construction

[87] Vining and Globerman (1999) applied their framework to various combinations of product complexity and asset specificity.

companies. However, in my opinion, the data collected could ultimately be available for the study of subcontracting decisions applying TCE within the Chinese CI and further a field. This paper is very much a progress report, and I think it can be continued and further developed.

Bibliography

Albino, Vito and Garavelli, A Claudio (1998), "A neural network application to subcontractor rating in construction firms", *International Journal of Project Management*, Vol. 16, No. 1, pp. 9-14.

Amesse, Fernand; Dragoste, Liliana; Nollet, Jean and Ponce, Silvia (2001), "Issues on partnering: evidences from subcontracting in aeronautics", *Technovation*, Vol. 21, pp. 559-569.

Anderson, Erin (1985), "The Salesperson as outside Agent or Employee: A Transaction Cost Analysis", *Marketing Science*, Vol. 4, No. 3, pp. 234-254.

Ang, Soon and Cummings, Larry L. (1997), "Strategic Response to Institutional Influences on Information Systems Outsourcing", *Organization Science*, Vol. 8, No. 3, pp. 235-256.

Argyres, Nicholas S. (1996), "Evidence on the role of firm capabilities in vertical integration decisions", *Strategic Management Journal*, Vol. 17, No. 2, pp.129-50.

Arnold, Ulli (2000), "New dimensions of outsourcing: a combination of transaction cost economics and the core competencies concept", *European Journal of Purchasing & Supply Management*, Vol. 6, pp. 23-29.

Beach, R., Webster, M. and Campbell, K.M. (2005), "An evaluation of partnership development in the construction industry", *International Journal of Project Management*, Vol. 23, pp. 611–621.

Beard, T. Randolph; Ford, George S. and Koutsky, Thomas M. (2005), "Mandated access and the make-or-buy decision: the case of local telecommunications competition", The Quarterly Review of Economics and Finance, Vol. 45, pp. 28-47.

Bertrand, J.W.M. and Sridharan, V. (2001), "A study of simple rules for subcontracting in make-to-order manufacturing", *European Journal of Operational Research*, Vol. 128, pp. 509-531.

Besanko, David et al. (2004), *The Economics of strategy*, 3rd edition, Hoboken, NJ: John Wiley & Sons, Inc.

Bigelow, Lyda S. (2004), "Make-or-Buy Revisited: A Longitudinal, Population-wide Test of Transaction Cost Alignment", *Working Paper: Washington University.* Available: http://www.rotman.utoronto.ca/ (Accessed: 19th June, 2006).

Black, Ken. (2004), *Business statistics: for contemporary decision making*, 4th edition, Hoboken, NJ: Wiley.

Blaxill, Mark F. and Hout, Thomas H. (1991), *The Fallacy of the Overhead Quick Fix*, Harvard Business Review, July-August, pp. 93-101.

Blinder, Alan S. (1991), "Why are Prices Sticky? Preliminary Results from an Interview Study", *The American Economic Review*, Vol. 81, No. 2, pp. 89-96. Papers and Proceedings of the Hundred and Third Annual Meeting of the American Economic Association.

Boer, Luitzen de; Wegen, Leo van der and Telgen, Jan (1998), "Outranking methods in support of supplier selection", *European Journal of Purchasing and Supply Management*, Vol. 4, No. 2, pp. 109-118.

Bowersox, DJ and Cooper, MB (1992), *Strategic marketing channel management*, New York: McGraw-Hill.

Brandes, Henrik; Lilliecreutz, Johan and Brege, Staffan (1997), "Outsourcing success or failure? Findings from five case studies", *European Journal of Purchasing & Supply Management*, Vol. 3, No. 2, pp. 63-75.

Buchowicz, Bruce S. (1991), "A Process Model of Make-vs.-Buy Decision-Making; The Case of Manufacturing Software", *IEEE Transactions on Engineering Management*, Vol. 38, No. 1, pp. 24-32

Buehler, Stefan and Haucap, Justus (2004), "A Primer in Strategic Outsourcing",

Business Briefing: Global Purchasing and Supply Chain Strategies. Available: http://www.bbriefings.com / (Accessed: 21st June, 2006).

Burnett, Robert G. (1991), *Insolvency and the sub-contractor*, Ascot: Chartered Institute of Building.

Canez, Laura and Probert, David (1999), "Technology Sourcing: The Link to Make-or-Buy", *Management of Engineering and Technology*, Vol. 2, pp. 47-52.

Carroll, Glenn R.; Bigelow, Lyda S.; Seidel, Marc-David and Tsai, Lucia (1996), "The fates of de novo and de alio producers in the American automobile industry 1885-1981", *Strategic Management Journal*, Vol. 17, pp. 117-137.

Chan, William K L; Wong, Francis K W and Scott, David (1999), "Managing construction projects in China—the transitional period in the millennium", *International Journal of Project Management*, Vol. 17, No. 4, pp. 257-263.

Chang, C.Y. (2006), "The determinants of the vertical boundaries of the construction firm: comment", *Construction Management and Economics*, Vol. 24, No. 3, pp. 229-232.

Chen, Ping and Partington, David (2004), "An interpretive comparison of Chinese and Western conceptions of relationships in construction project management work", *International Journal of Project Management*, Vol. 22, pp. 397-406.

Chen, Yongqiang; Lu, Wenxue and Zhang, Shuibo (2005), "Developing an Integrated Management System of Engineering Projects", *China Civil Engineering Journal*, Vol. 38, No. 5, pp. 111-115. (In Chinese)

Cheng, Yik-kee (1994), *Quality control mechanisms of the construction project in the People's Republic of China: a case study in Dongguan*, London: [unpublished], Thesis (M.Sc. - Construction Economics and Management) - University College London.

Churcher, D. W (1996), *The control of quality on construction sites*, London:

Construction Industry Research and Information Association.

Coase, Ronald H. (1937), "The Nature of the Firm", *Economica*, Vol. 4, No. 16, pp. 386-405.

Coles, Jerilyn W. and Hesterly, William S. (1998a), "The impact of firm-specific assets and the interaction of uncertainty: an examination of make-or-buy decisions in public and private hospitals", *Journal of Economic Behavior & Organization*, Vol. 36, pp. 383-409.

Coles, Jerilyn W. and Hesterly, William S. (1998b), "Transaction costs, quality, and economies of scale: examining contracting choices in the hospital industry", *Journal of Corporate Finance*, Vol. 4, No. 4, pp. 321-345.

Cooper, Robin and Slagmulder, Regine (2004), "Interorganizational cost management and relational context", *Accounting, Organizations and Society*, Vol. 29, pp. 1-26.

Cox, A.W. (1996), "Relational competence and strategic procurement management: towards an entrepreneurial and contractual theory of the firm", *European Journal of Purchasing and Supply Management*, Vol. 2 No. 1, pp. 57-70.

Crawford, Lynn and Costello, Kerry et al. (2003), "Managing soft change projects in the public sector", *International Journal of Project Management*, Vol. 21, pp. 443-448.

Debrah, Yaw A. and Ofori, George (2001), "Subcontracting, Foreign Workers and Job Safety in the Singapore Construction Industry", *Asia Pacific Business Review*, Vol.8, No.1, pp.145-166.

Domberger, Simon. (1998), *The contracting organization: a strategic guide to outsourcing*, Oxford; New York: Oxford University Press.

Eccles, R.G. (1981), "The Quasifirm in the Construction Industry", *Journal of Economic Behaviour and Organisation*, Vol. 2, No. 4, pp. 355-57.

Fan, Linda (1988), "Equity joint ventures in the Chinese construction industry", *International Journal of Project Management*, Vol. 6, No. 1,

Farrell, Joseph (1987), "Information and coase theorem", *Journal of Economic Perspectives*, Vol. 1, No. 2, pp. 113-129.

Flanagan, Roger and Li, Shirong (1997), *International construction: a perspective of China*, Ascot: Chartered Institute of Building.

Franks, James (1984), *Building sub-contract management*, London: Construction Press.

Franks, James (1986), *Building sub-contractor's claims — avoidance or submission*, Berkshire: Chartered Institute of Building

Frederix, Florent (2001), "An extended enterprise planning methodology for the discrete manufacturing industry", *European Journal of Operational Research*, Vol. 129, No. 2, pp. 317-325.

Fredland, J. Eric (2004), "Outsourcing Military Force: A Transactions Cost Perspective on the Role of Military Companies", *Defence and Peace Economics*, Vol. 15, No. 3, pp. 205-219.

Gietzmann, Miles B. (1996), "Incomplete contracts and the make-or-buy decision: Governance design and attainable flexibility", *Accounting, Organizations and Society*, Vol. 21, No. 6, pp. 611-626.

Goldsby, Thomas J. and Eckert, James A. (2003), "Electronic transportation marketplaces: a transaction cost perspective", *Industrial Marketing Management*, Vol. 32, pp. 187-198.

González-Díaz, Manuel; Arruñada, Benito and Fernández, Alberto (2000), "Causes of subcontracting: evidence from panel data on construction firms", *Journal of Economic Behavior and Organization*, Vol. 42, pp. 167-187.

Görg, Holger and Hanley, Aoife (2004), "Does Outsourcing Increase Profitability?", *The Economic and Social Review*, Vol. 35, No. 3, pp. 267-288.

Hannan, Michael T.; Carroll, Glenn R.; Dundon, Elizabeth A. and Torres, John C. (1995), "Organizational evolution in multinational context: entries of automobile manufacturers in Belgium, Britain, France, Germany and Italy", *American Sociological Review*, Vol. 60, pp.509-528.

Hamel, Gary and Prahalad, C.K. (1994), *Competing for the future*, Boston, Mass: Harvard Business School Press.

Herzfeld, Edgar and Hadley, Richard (1988), *Contracting and subcontracting for overseas projects*, London; Boston: Graham & Trotman Ltd.

Hodgkin, Dominic; Horgan, Constance M. and Garnick, Deborah W. (1997), "Make-or-buy: HMOs' contracting arrangements for mental health care", *Administration and Policy in Mental Health*, Vol. 24, No. 4, pp. 359-376.

Hui, Chun and Craen, Ceorge (1997), "Guanxi and Professional Leadership in Contemporary Sino-American Joint Ventures in Mainland China", *Leadership Quarterly*, Vol. 8, No. 4, pp. 451-466.

Humphreys, P.; McIvor, R. and Huang, G. (2002), "An expert system for evaluating the make-or-buy decision", *Journal of Computers and Industrial Engineering*, Vol. 42, No. 2-4, pp. 567-585.

Jacobides, Michael G. (2005), "Designing the boundaries of the firm: from "make, buy or ally" to the dynamic benefits of vertical architecture", *London Business School: Strategic and International Management Working Paper Series*, Vol. 5.8. Available: http://www.kellogg.northwestern.edu/mors/faculty/seminars/jacobides2.pdf (Accessed: 20th June, 2006).

Javidan, Mansour, (1998), "Core Competence: What Does It Mean in Practice?", *Long Range Planning*, Vol. 31, No.1, pp. 60-71.

Jenkins, T.N. (2002), "Chinese traditional thought and practice: lessons for an ecological economics worldview", *Ecological Economics*, Vol. 40, pp. 39-52.

Jensen, J. Bradford and Rothwell, Geoffrey S. (1998), "Transaction costs, regulation, and subcontracting at nuclear power plants", *Journal of Economic Behavior & Organization*, Vol. 36, No. 3, pp. 369-381.

Jin, Xiao-Hua and Ling, Florence Yean Yng (2006), "Key relationship-based determinants of project performance in China", *Building and Environment*, Vol. 41, pp. 915-925.

Johnson, G., Scholes, K. and Whittington, R. (2005), *Exploring Corporate Strategy*, Harlow: Financial Times Prentice Hall.

Johnson, Shane A. and Houston, Mark B. (2000), "Buyer-Supplier Contracts versus Joint Ventures: Determinants and Consequences of Transaction Structure", *Journal of Marketing Research*, Vol. 37, No, 1, pp. 1-15.

Kakabadse, Andrew and Kakabadse, Nada (2005), "Outsourcing: Current and Future Trends", *Thunderbird International Business Review*, Vol. 47, No. 2, pp.183-204.

Lacity, Mary C. and Willcocks, Leslie P. (1998), "An Empirical Investigation of Information Technology Sourcing Practices: Lessons from Experience", *MIS Quarterly*, Vol. 22, No. 3, pp. 363-408.

Lafontaine, Francine and Slade, Margaret E. (1997), "Retail Contracting: Theory and Practice", *The Journal of Industrial Economics*, Vol. 45, No. 1, pp. 1-25.

Lai, Lawrence Wai Chung (2000), "The Coasian market-firm dichotomy and subcontracting in the construction industry", *Construction Management and Economics*, Vol. 18, No. 33, pp. 355-362.

Laia, K.K.; Liub, S.L. and Wang, S.Y. (2004), "A method used for evaluating bids in the Chinese construction industry", *International Journal of Project Management*, Vol. 22, pp. 193-201.

Lefebvre, Élisabeth and Lefebvre, Louis A. (1998), "Global strategic benchmarking, critical capabilities and performance of aerospace subcontractors", *Technovation*, Vol. 18, No. 4, pp. 223-234.

Leiblein, Michael J.; Reuer, Jeffrey J. and Dalsace, Frédéric (2002), "Do make-or-buy decisions matter? The influence of organizational governance on technological performance", *Strategic Management Journal*, Vol. 23, No. 9, pp. 817-833.

Lina, Z. Jun and Johnson, Stev (2004), "An exploratory study on accounting for quality management in China", *Journal of Business Research*, Vol. 57, pp. 620-632.

Liu, Guiwen and Shen, Qiping et al. (2004), "Factors constraining the development of professional project management in China's construction industry", *International Journal of Project Management*, Vol. 22, pp. 203-211.

Madhok, Anoop (1996), "Organisation of Economic Activity: Transaction Cost, Firm capabilities, and the Nature of Governance", *Organization Science*, Vol.7, No.5, pp. 577-590.

Madhok, Anoop (2002), "Reassessing the Fundamentals and Beyond: Ronald Coase, the Transaction Cost and Resource-Based Theories of the Firm and the Institutional Structure of Production", Strategic Management Journal, Vol. 23, pp. 535-550.

Majumdar, Sumit K. and Ramaswamy, Venkatram (1994), "Explaining downstream integration", *Managerial and Decision Economics*, Vol. 15, No. 2, pp. 119-129.

Mantel, Susan Powell; Tatikonda, Mohan V. and Liao, Ying (2005), "A behavioral study of supply manager decision-making: Factors influencing make versus buy evaluation", *Journal of Operations Management*, Article in Press, Available: http://www.sciencedirect.com/ (Accessed: 20th June, 2006).

Martinsons, Maris G. and Westwood, Robert I. (1997), "Management information systems in the Chinese business culture: An explanatory theory", *Information & Management*, Vol. 32, pp. 215-228.

Masten, Scott E. (1984), "The Organization of Production: Evidence from the Aerospace Industry", *Journal of Law and Economics*, Vol. 27, No. 2, pp. 403-417.

Masten, Scott E.; Meehan, James W. Jr.; Snyder, Edward A. (1991), "The Costs of Organization", *Journal of Law, Economics, and Organization*, Vol. 7, No. 1, pp. 1-25.

Mayer, Kyle J. and Argyres, Nicholas S. (2004), "Learning to contract: Evidence from the personal computer industry", *Organization Science*, Vol. 15, No. 4, pp. 394-410.

McIvor, Ronan T. (2000), "A practical framework for understanding the outsourcing process", *Supply Chain Management: An International Journal*, Vol. 5, No. 1, pp. 22-36.

McIvor, Ronan T.; Mulvenna, M. D. and Humphreys, P. K. (1997), "A Hybrid Knowledge-Based System for Strategic Purchasing", *Expert Systems With Applications*, Vol. 12, No. 4, pp. 497-512.

McNally, Regina C. and Griffin, Abbie (2004), "Firm and Individual Choice Drivers in Make-or-Buy Decisions: A Diminishing Role for Transaction Cost Economics?", *The Journal of Supply Chain Management: A Global Review of Purchasing and Supply*, Vol. 40, No. 1, pp. 4-17.

Monteverde, Kirk and David Teece, (1982), "Supplier Switching Costs and Vertical Integration in the Automobile Industry", *Bell Journal of Economics*, Vol. 13, pp. 206-213.

National Bureau of Statistics of China, Available: http://www.stats.gov.cn/english/statisticaldata/ (Accessed: 12th July, 2006).

Ngwenyama, Ojelanki K. and Bryson, Noel (1999), "Making the information systems outsourcing decision: A transaction cost approach to analyzing outsourcing decision problems", *European Journal of Operational Research*, Vol. 115, No. 22, pp. 351-367.

Ofori, George and Han, Sun Sheng (2003), "Testing hypotheses on construction and development using data on China's provinces, 1990–2000", *Habitat International*, Vol. 27, No. 1, pp. 37-62.

Olson, Richard (1998), "Subcontract coordination in construction", *International Journal of Production Economics*, Vol. 56-57, pp. 503-509.

Ono, Yukako and Stango, Victor (2005), "Outsourcing, firm size, and product complexity: evidence from credit unions", *Economic Perspectives-Federal Reserve Bank of Chicago*, Vol. QI, pp. 12-29. Available: http://www.chicagofed.org/publications/economicperspectives/ep_1qtr2005_part1_ono_stango.pdf (Accessed: 15th June, 2006).

Padillo, José M. and Meyersdorf, Doron (1996), "The Make-or-Buy Problem: A Multidimensional Perspective of Foundry Decisions", *IEEE/SEMI Advanced Semiconductor Manufacturing Conference and Workshop, ASMC 96 Proceedings*, pp. 197-202. Available: http://ieeexplore.ieee.org/ (Accessed: 11th June, 2006).

Peng, Mike W; Hill, Charles W. L. and Wang, Denis Y. L. (2000), "Schumpeterian Dynamics Versus Williamsonian Considerations: A Test of Export Intermediary Performance", *Journal of Management Studies*, Vol. 37, No. 2, pp. 167-184.

Peng, Mike W.; Zhou, Yuanyuan and York, Anne S. (2006), "Behind make-or-buy decisions in export strategy: A replication and extension of Trabold", *Journal of World Business*, Article in Press, Available: http://www.sciencedirect.com/ (Accessed: 19th June, 2006).

Platts, K.W.; Probert, D.R. and Cáñez L. (2002), "Make vs. buy decisions: A process incorporating multi-attribute decision-making", *International Journal of Production Economics*, Vol. 77, No. 3, pp. 247-257.

Poppo, Laura and Zenger, Todd (1998), "Testing Alternative Theories of the Firm: Transaction Cost, Knowledge-Based, and Measurement Explanations for Make-or-Buy Decisions in Information Services", *Strategic Management Journal*, Vol. 19, No. 99, pp. 853-877.

Probert, D.R. (1996), "Make-or-buy: understanding the impact of technology choices", *IEE Colloquium on Manufacturing Strategy*, pp. 4/1-4/4. Available: http://ieeexplore.ieee.org/ (Accessed: 30th June, 2006).

Rajan, Raghuram G. and Zingales, Liugi (1998), "Power in a Theory of Firm", *The Quarterly Journal of Economics*, Vol. 113, No. 2, pp. 387-432.

Ranns, R.H.B. and Ranns, E.J.M. (2005), *Practical construction management*, London: Taylor & Francis

Ronen, Simcha and Shenkar, Oded (1985), "Clustering Countries on Attitudinal Dimensions: A Review and Synthesis", *The Academy of Management Review*, Vol. 10, No. 3, pp. 435-454.

Roodhooft, Filip and Warlop, Luk (1999), "On the role of sunk costs and asset specificity in outsourcing decisions: a research note", *Accounting, Organizations and Society*, Vol. 24, No. 4, pp. 363-369.

Sha, Kaixun (2004), "Construction business system in China: an institutional transformation perspective", *Building Research & Information*, Vol. 32, No. 6, pp. 529-537.

Simon, Peter and Hillson, David et al. (ed.) (1997), *PRAM: Project risk analysis and management guide*, Norwich, Norfolk: APM Group Limited.

Stock, James H. and Watson, Mark W. (2003), *Introduction to Econometrics*, Boston, MA; London: Addison Wesley.

Tadelis, Steven (2002), "Complexity, Flexibility, and the Make-or-Buy Decision", *The American Economic Review*, Vol. 92, No, 2, pp. 433-437.

Tam, C.M.; Zeng, S.X. and Deng, Z.M. (2004), "Identifying elements of poor construction safety management in China", *Safety Science*, Vol. 42, No. 77, pp. 569-586.

Tayles, Mike and Drury, Colin (2001), "Moving from Make/Buy to Strategic Sourcing: The Outsource Decision Process", *Long Range Planning*, Vol. 34, no. 5, pp. 605-622.

Usdiken, Behlul; Sozen, Zeynep and Enbiyaoglu, Hayat (1988), "Strategies and boundaries: subcontracting in construction", *Strategic Management Journal*, Vol. 9, No. 6, pp. 633-637.

Veloso, Francisco and Fixson, Sebastian (2001), "Make–Buy Decisions in the Auto Industry: New Perspectives on the Role of the Supplier as an Innovator", *Technological Forecasting and Social Change*, Vol. 67, No. 2, pp. 239-257.

Veugelers, Reinhilde and Cassiman, Bruno (1999), "Make and buy in innovation strategies: evidence from Belgian manufacturing firms", *Research Policy*, Vol. 28, pp. 63-80.

Vining, Aidan and Globerman, Steven (1999), "A Conceptual Framework for Understanding the Outsourcing Decision", *European Management Journal*, Vol. 17, No. 6, pp. 645-654.

Walker, Anthony (1995), *Hong Kong: the contractors' experience*, Hong Kong: Published for the Hong Kong Construction Association by Hong Kong University Press.

Walker, Anthony and Chau, Kwong Wing (1999), "The relationship between construction project management theory and transaction cost economics", *Engineering Construction and Architectural Management*, Vol. 6, No. 2, pp. 166-176.

Walker, Gordon and Weber, David (1984), "A Transaction Cost Approach to Make-or-Buy Decisions", *Administrative Science Quarterly*, Vol. 29, No. 3, pp. 373-391.

Walker, Gordon and Weber, David (1987), "Supplier Competition, Uncertainty, and Make-or-Buy Decisions", *The Academy of Management Journal*, Vol. 30, No. 3, pp. 589-596.

Wang, Xu-dong and Guo, Yi-lin (2006), "Mode-based Research of Virtual Construction Enterprise Partner Selection", *Journal of Xingtai Vocational and Technical College*, Vol. 23, No. 1, pp. 22-25. (In Chinese)

White, Steven (2000), "Competition, Capabilities, and the Make, Buy, or Ally Decisions of Chinese State-Owned Firms", *The Academy of Management Journal*, Vol. 43, No. 3, pp.324-341.

Williamson, Oliver E. (1975), *Markets and hierarchies: analysis and antitrust implications: a study in the economics of internal organization*, New York: Free Press; London: Collier Macmillan.

Williamson, Oliver E. (1979), "Transaction-Cost Economics: The Governance of Contractual Relations", *Journal of Law and Economics*, Vol. 22, No. 2, pp. 233-261.

Williamson, Oliver E. (1981), "The Economics of Organization: The Transaction Cost Approach", *American Journal of Sociology*, Vol. 87, No. 3, pp. 548-577.

Williamson, Oliver E. (1985), *The economic institutions of capitalism: firms, markets, relational contracting*, New York: Free Press; London: Collier Macmillan.

Williamson, Oliver E. and Masten, Scott E. (ed.) (1995), *Transaction cost economics (VI and VII)*, Aldershot, Hants, England; Brookfield, Vt: Edward Elgar.

Yan, fu Jiang and Gang, Zhou et al. (1999), "Information Structure, Contract Theory and Corporate Governance", *The 4th Annual International Conference on Transition Economics*, Paper No. D04. Available: http://www.ncer.tsinghua.edu.cn/ (Accessed: 16th April, 2006).

Ye, Min (2001), "Research on scale structure of Chinese architecture enterprise", *East China Economic Management*, Vol.15, No.4. (In Chinese)

Yeo, K T (1993), "Systems thinking and project management—time to reunite", *International Journal of Project Management*, Vol. 11, No. 2, pp. 111-117.

Yoon, K. P., and Naadimuthu, G. (1994). "A make-or-buy decision analysis involving imprecise data", *International Journal of Operations and Production Management*, Vol. 14, No. 2, pp. 62-69.

Zhang, Li-xin; Fan, Qing-ze and Guo, Xiu-rong (2003), "Research on the Contract Management for Subcontractor", *Journal of Chongqing Jianzhu University*, Vol. 25, No. 4, pp. 86-90. (In Chinese)

Appendix 1

An Outline of the Survey of Subcontracting Practices in China's Construction Industry

Location:_____ **Date: ____/____/2006**

Visited Firm:_____

【Stage 1】

Please briefly introduce the profile of the company. (Works engaged in, turnover, number of employees, etc.)

Get some paper format documents.

【Stage 2】

Ask the interviewees the percentage of the eleven subentries of subcontracting for their corporation ('>50%' or '<50%'), and then evaluating of the nine measurement variables, which derives from the hypotheses in Chapter 5, using a 10-point scale in which '1' represented "low degree" ("not important") and '10' represented "high degree" ("most important").

Table A1. 1 Interview Table for Measurement of Variables

Type of Subcontracting					Measurement of Explanatory Variables for the Make-or-Buy Decision								
Category	Type of Work	Type of Trade	Percentage		V1	V2	V3	V4	V5	V6	V7	V8	V9
1	**Roof**	Roofing	In-house										
			Outsource										
		Waterproof	In-house										
			Outsource										
2	**Drywall Frames**	Brickwork	In-house										
			Outsource										
3	**Decoration & Fitment**	Plastering	In-house										
			Outsource										
		Tiling	In-house										
			Outsource										
		Painting	In-house										
			Outsource										
		Flooring	In-house										
			Outsource										
4	**Installation**	Electrical	In-house										
			Outsource										
		Plumbing	In-house										
			Outsource										
		Heating & cooling	In-house										
			Outsource										
		Intelligent Building	In-house										
			Outsource										

【Stage 3】

Ask the interviewees to assess the weightiness of Eccles' (1981) seven reasons of subcontracting.

Table A1. 2 Interview Table for Evaluation of Eccles' 7 Reasons

Type of Subcontracting			Measurement of Explanatory Variables for the Make-or-Buy Decision						
Category	**Type of Work**	**Type of Trade**	**R1**	**R2**	**R3**	**R4**	**R5**	**R6**	**R7**
1	**Roof**	Roofing							
		Waterproof							
2	**Drywall Frames**	Brickwork							
3	**Decoration & Fitment**	Plastering							
		Tiling							
		Painting							
		Flooring							
4	**Installation**	Electrical							
		Plumbing							
		Heating & cooling							
		Intelligent Building							

Appendix 2

Interview Results

Table A2. 1 Four Samples' Evaluation Result of Explanatory Variables

Type of Subcontracting				Measurement of Explanatory Variables for the Make-or-Buy Decision								
Type of Trade	Company	Percentage		V1	V2	V3	V4	V5	V6	V7	V8	V9
Roofing	SCG	In-house	<50%	5	10	5	5	5	5	10	10	1
		Outsource	>50%									
	CCEED	In-house	>50%	7	1	1	1	1	5	1	6	6
		Outsource	<50%									
	CCSEB	In-house	>50%	1	3	2	5	9	7	4	8	4
		Outsource	<50%									
	BCEG	In-house	>50%	5	3	8	9	7	7	6	2	5
		Outsource	<50%									
	Mean Value			4.5	4.25	4	5	5.5	6	5.25	6.5	4
	Std. Dev			2.52	3.95	3.16	3.27	3.42	1.15	3.77	3.42	2.16
	Min			1	1	1	1	1	5	1	2	1
	Max			7	10	8	9	9	7	10	10	6
Waterproof	SCG	In-house	<50%	5	10	5	5	5	5	10	10	1
		Outsource	>50%									
	CCEED	In-house	<50%	7	1	1	9	1	8	3	1	8
		Outsource	>50%									
	CCSEB	In-house	<50%	1	3	2	5	9	7	4	8	4
		Outsource	>50%									
	BCEG	In-house	<50%	5	3	8	9	7	7	6	2	5
		Outsource	>50%									
	Mean Value			4.5	4.25	4	7	5.5	6.75	5.75	5.25	4.5
	Std. Dev			2.52	3.95	3.16	2.31	3.42	1.26	3.1	4.43	2.89
	Min			1	1	1	5	1	5	3	1	1
	Max			7	10	8	9	9	8	10	10	8
Brickwork	SCG	In-house	<50%	5	10	5	5	5	5	10	10	1
		Outsource	>50%									
	CCEED	In-house	>50%	7	1	1	1	1	5	1	6	6
		Outsource	<50%									

	CCSEB	In-house	<50%	1	2	3	2	2	5	5	7	7
		Outsource	>50%									
	BCEG	In-house	>50%	1	1	2	3	8	9	1	1	1
		Outsource	<50%									
	Mean Value			3.5	3.5	2.75	2.75	4	6	4.25	6	3.75
	Std. Dev			3	4.36	1.71	1.71	3.16	2	4.27	3.74	3.2
	Min			1	1	1	1	1	5	1	1	1
	Max			7	10	5	5	8	9	10	10	7
Plastering	SCG	In-house	<50%	5	10	5	5	5	5	10	10	1
		Outsource	>50%									
	CCEED	In-house	>50%	7	1	1	1	1	5	1	6	6
		Outsource	<50%									
	CCSEB	In-house	<50%	1	2	3	3	4	5	5	4	6
		Outsource	>50%									
	BCEG	In-house	>50%	1	1	2	3	9	9	1	1	1
		Outsource	<50%									
	Mean Value			3.5	3.5	2.75	3	4.75	6	4.25	5.25	3.5
	Std. Dev			3	4.36	1.71	1.63	3.3	2	4.27	3.77	2.89
	Min			1	1	1	1	1	5	1	1	1
	Max			7	10	5	5	9	9	10	10	6
Tiling	SCG	In-house	>50%	8	10	5	8	5	5	10	10	1
		Outsource	<50%									
	CCEED	In-house	>50%	8	7	1	1	1	3	1	7	7
		Outsource	<50%									
	CCSEB	In-house	>50%	1	2	4	6	5	7	5	7	4
		Outsource	<50%									
	BCEG	In-house	>50%	1	1	6	9	5	5	1	1	1
		Outsource	<50%									
	Mean Value			4.5	5	4	6	4	5	4.25	6.25	3.25
	Std. Dev			4.04	4.24	2.16	3.56	2	1.63	4.27	3.77	2.87
	Min			1	1	1	1	1	3	1	1	1
	Max			8	10	6	9	5	7	10	10	7
Painting	SCG	In-house	>50%	8	10	5	8	5	5	10	10	1
		Outsource	<50%									
	CCEED	In-house	>50%	8	7	1	8	1	3	1	7	7
		Outsource	<50%									
	CCSEB	In-house	>50%	1	2	4	6	6	7	5	7	5
		Outsource	<50%									
	BCEG	In-house	>50%	1	1	1	9	8	8	1	1	1
		Outsource	<50%									
	Mean Value			4.5	5	2.75	7.75	5	5.75	4.25	6.25	3.5
	Std. Dev			4.04	4.24	2.06	1.26	2.94	2.22	4.27	3.77	3
	Min			1	1	1	6	1	3	1	1	1

	Max			8	10	5	9	8	8	10	10	7
Flooring	SCG	In-house	<50%	8	10	5	8	5	5	10	10	1
		Outsource	>50%									
	CCEED	In-house	<50%	8	8	1	8	1	3	1	7	7
		Outsource	>50%									
	CCSEB	In-house	>50%	1	2	4	5	6	7	5	4	6
		Outsource	<50%									
	BCEG	In-house	<50%	1	1	5	9	7	6	1	1	1
		Outsource	>50%									
	Mean Value			4.5	5.25	3.75	7.5	4.75	5.25	4.25	5.5	3.75
	Std. Dev			4.04	4.43	1.89	1.73	2.63	1.71	4.27	3.87	3.2
	Min			1	1	1	5	1	3	1	1	1
	Max			8	10	5	9	7	7	10	10	7
Electrical	SCG	In-house	<50%	10	10	10	9	8	10	10	10	1
		Outsource	>50%									
	CCEED	In-house	>50%	7	1	1	1	1	5	1	7	7
		Outsource	<50%									
	CCSEB	In-house	>50%	4	5	6	6	7	8	6	8	3
		Outsource	<50%									
	BCEG	In-house	>50%	2	5	7	8	9	9	1	1	1
		Outsource	<50%									
	Mean Value			5.75	5.25	6	6	6.25	8	4.5	6.5	3
	Std. Dev			3.5	3.69	3.74	3.56	3.59	2.16	4.36	3.87	2.83
	Min			2	1	1	1	1	5	1	1	1
	Max			10	10	10	9	9	10	10	10	7
Plumbing	SCG	In-house	>50%	10	10	10	9	8	10	10	10	1
		Outsource	<50%									
	CCEED	In-house	>50%	7	1	1	1	1	4	1	6	6
		Outsource	<50%									
	CCSEB	In-house	>50%	4	5	6	6	7	8	6	8	3
		Outsource	<50%									
	BCEG	In-house	>50%	2	5	7	8	9	9	1	1	1
		Outsource	<50%									
	Mean Value			5.75	5.25	6	6	6.25	7.75	4.5	6.25	2.75
	Std. Dev			3.5	3.69	3.74	3.56	3.59	2.63	4.36	3.86	2.36
	Min			2	1	1	1	1	4	1	1	1
	Max			10	10	10	9	9	10	10	10	6
Heating & cooling	SCG	In-house	>50%	10	10	10	9	8	10	10	10	1
		Outsource	<50%									
	CCEED	In-house	>50%	7	1	1	1	1	4	1	6	6
		Outsource	<50%									
	CCSEB	In-house	>50%	4	5	6	6	7	8	6	8	3
		Outsource	<50%									

	BCEG	In-house	>50%	2	5	7	8	9	9	1	1	1
		Outsource	<50%									
	Mean Value			5.75	5.25	6	6	6.25	7.75	4.5	6.25	2.75
	Std. Dev			3.5	3.69	3.74	3.56	3.59	2.63	4.36	3.86	2.36
	Min			2	1	1	1	1	4	1	1	1
	Max			10	10	10	9	9	10	10	10	6
Intelligent Building	SCG	In-house	<50%	10	10	10	9	8	10	10	10	1
		Outsource	>50%									
	CCEED	In-house	<50%	9	8	6	9	3	4	1	8	8
		Outsource	>50%									
	CCSEB	In-house	<50%	4	5	6	6	7	8	6	8	3
		Outsource	>50%									
	BCEG	In-house	<50%	1	1	2	9	4	5	8	1	1
		Outsource	>50%									
	Mean Value			6	6	6	8.25	5.5	6.75	6.25	6.75	3.25
	Std. Dev			4.24	3.92	3.27	1.5	2.38	2.75	3.86	3.95	3.3
	Min			1	1	2	6	3	4	1	1	1
	Max			10	10	10	9	8	10	10	10	8

Table A2. 2 SUCG's Evaluation Result of Explanatory Variables

Type of Subcontracting					Measurement of Explanatory Variables for the Make-or-Buy Decision								
Category	Type of Work	Type of Trade	Percentage		V1	V2	V3	V4	V5	V6	V7	V8	V9
1	**Foundation**	Piling	In-house	>50%	8	5	4	2	2	2	5	5	5
			Outsource	<50%									
2	**Drywall Frames**	Depress Water Line	In-house	<50%	5	4	4	7	5	7	7	6	4
			Outsource	>50%									
		Digging	In-house	<50%	4	3	3	4	3	8	8	7	3
			Outsource	>50%									
		Reinforcing	In-house	<50%	7	7	6	8	7	7	8	6	5
			Outsource	>50%									
3	**Framework**	Reinforcing Steel	In-house	>50%	2	2	2	2	3	5	8	7	3
			Outsource	<50%									
		Concrete	In-house	>50%	4	3	2	2	3	6	7	6	3
			Outsource	<50%									
		Bracket	In-house	>50%	5	3	3	2	3	5	7	7	3
			Outsource	<50%									
		Moulding	In-house	>50%	5	3	3	2	2	5	7	7	2
			Outsource	<50%									

Table A2. 3 Four Samples' Evaluation Result of Eccles' 7 Reasons

Evaluation Result of Eccles' Seven Reasons for Subcontracting								
Type of Subcontracting		**Weightiness Evaluation of Eccles' Seven Reasons for Subcontracting**						
Type of Trade	Company	**R1**	**R2**	**R3**	**R4**	**R5**	**R6**	**R7**
Roofing	SCG	8	10	10	7	10	5	1
	CCEED	3	7	1	10	4	5	5
	CCSEB	4	4	6	6	8	2	1
	BCEG	6	8	1	1	3	10	4
	Mean Value	5.25	7.25	4.50	6.00	6.25	5.50	2.75
	Std. Dev	2.22	2.50	4.36	3.74	3.30	3.32	2.06
	Min	3	4	1	1	3	2	1
	Max	8	10	10	10	10	10	5
Waterproof	SCG	8	10	10	7	10	5	1
	CCEED	3	7	1	10	4	5	5
	CCSEB	4	4	6	6	8	2	1
	BCEG	6	8	1	1	3	10	4
	Mean Value	5.25	7.25	4.50	6.00	6.25	5.50	2.75
	Std. Dev	2.22	2.50	4.36	3.74	3.30	3.32	2.06
	Min	3	4	1	1	3	2	1
	Max	8	10	10	10	10	10	5
Brickwork	SCG	8	10	10	7	9	5	1
	CCEED	5	8	1	8	2	1	1
	CCSEB	6	8	8	5	4	2	1
	BCEG	7	8	1	1	2	10	2
	Mean Value	6.50	8.50	5.00	5.25	4.25	4.50	1.25
	Std. Dev	1.29	1.00	4.69	3.10	3.30	4.04	0.50
	Min	5	8	1	1	2	1	1
	Max	8	10	10	8	9	10	2
Plastering	SCG	8	10	10	5	9	5	1
	CCEED	5	8	1	8	2	1	1
	CCSEB	4	6	8	4	2	5	1
	BCEG	2	2	3	3	3	3	3
	Mean Value	4.75	6.50	5.50	5.00	4.00	3.50	1.50
	Std. Dev	2.50	3.42	4.20	2.16	3.37	1.91	1.00
	Min	2	2	1	3	2	1	1
	Max	8	10	10	8	9	5	3

Tiling	SCG	8	9	10	5	9	5	1
	CCEED	8	7	1	8	5	1	1
	CCSEB	6	8	6	5	2	4	1
	BCEG	2	2	3	3	3	3	3
	Mean Value	6.00	6.50	5.00	5.25	4.75	3.25	1.50
	Std. Dev	2.83	3.11	3.92	2.06	3.10	1.71	1.00
	Min	2	2	1	3	2	1	1
	Max	8	9	10	8	9	5	3
Painting	SCG	8	9	10	5	9	6	1
	CCEED	7	8	1	8	4	1	1
	CCSEB	6	8	6	5	2	4	1
	BCEG	2	2	3	3	3	3	3
	Mean Value	5.75	6.75	5.00	5.25	4.50	3.50	1.50
	Std. Dev	2.63	3.20	3.92	2.06	3.11	2.08	1.00
	Min	2	2	1	3	2	1	1
	Max	8	9	10	8	9	6	3
Flooring	SCG	8	9	10	5	9	6	1
	CCEED	6	7	1	8	5	1	1
	CCSEB	6	8	6	5	2	4	1
	BCEG	2	2	3	3	3	3	3
	Mean Value	5.50	6.50	5.00	5.25	4.75	3.50	1.50
	Std. Dev	2.52	3.11	3.92	2.06	3.10	2.08	1.00
	Min	2	2	1	3	2	1	1
	Max	8	9	10	8	9	6	3
Electrical	SCG	8	9	10	5	9	6	1
	CCEED	7	8	1	8	4	2	2
	CCSEB	7	6	4	7	2	6	2
	BCEG	2	2	2	2	6	8	10
	Mean Value	6.00	6.25	4.25	5.50	5.25	5.50	3.75
	Std. Dev	2.71	3.10	4.03	2.65	2.99	2.52	4.19
	Min	2	2	1	2	2	2	1
	Max	8	9	10	8	9	8	10
Plumbing	SCG	8	9	10	5	9	6	1
	CCEED	7	8	1	8	4	2	2
	CCSEB	7	6	4	7	2	6	2
	BCEG	2	2	2	2	6	8	10
	Mean Value	6.00	6.25	4.25	5.50	5.25	5.50	3.75
	Std. Dev	2.71	3.10	4.03	2.65	2.99	2.52	4.19

	Min	2	2	1	2	2	2	1
	Max	8	9	10	8	9	8	10
Heating & cooling	SCG	8	9	10	5	9	6	1
	CCEED	7	8	1	8	4	2	2
	CCSEB	7	6	4	7	2	6	2
	BCEG	2	2	2	2	6	8	10
	Mean Value	6.00	6.25	4.25	5.50	5.25	5.50	3.75
	Std. Dev	2.71	3.10	4.03	2.65	2.99	2.52	4.19
	Min	2	2	1	2	2	2	1
	Max	8	9	10	8	9	8	10
Intelligent Building	SCG	8	9	10	5	9	6	1
	CCEED	2	7	1	10	4	5	5
	CCSEB	7	6	4	7	2	6	7
	BCEG	2	2	2	2	6	8	10
	Mean Value	4.75	6.00	4.25	6.00	5.25	6.25	5.75
	Std. Dev	3.20	2.94	4.03	3.37	2.99	1.26	3.77
	Min	2	2	1	2	2	5	1
	Max	8	9	10	10	9	8	10

Table A2. 4 SUCG's Evaluation Result of Eccles' 7 Reasons

Type of Subcontracting			**Weightiness Evaluation of Eccles' Seven Reasons for Subcontracting**						
Category	Type of Work	Type of Trade	**R1**	**R2**	**R3**	**R4**	**R5**	**R6**	**R7**
1	**Foundation**	Piling	3	3	8	5	8	5	5
2	**Drywall Frames**	Depress Water Line	3	3	5	5	8	5	5
		Digging	7	7	5	5	7	7	7
		Reinforcing	6	6	6	4	8	5	7
3	**Framework**	Reinforcing Steel	8	8	10	5	4	5	5
		Concrete	4	4	10	5	3	7	5
		Bracket	3	3	10	5	5	5	5
		Moulding	6	6	9	5	6	5	5

Table A2. 5 The Sixth Interviewee's Response

Influencing factors for subcontracting decisions	
Rank	Factor
1	The capability and reputation of subcontractors;
2	An internal subcontractors' name list of the enterprise, which shows the outstanding achievement of them;
3	The degree of specialisation;
4	The cost for maintenance and service in the future (i.e. the guarantee to keep waterproof in good repair is five years, main contractors can transfer this risk to subcontractors);
5	Some social factors (i.e. the relationship between client, government, main contractors, subcontractors. This influence may account for 30% when making the subcontracting decisions.);
6	Subcontractor's outstanding achievements in the near three years;
7	Capital strength of subcontractor (Some projects need subcontractors fund ahead of schedule. This influence may account for 10% when making the subcontracting decisions).

Note

In some literature, firm size is a significantly influencing factor in make-or-buy decisions. This is not applicable in China's CI. Through all these interviews, all the professionals in China do not think about this factor.

Appendix 3

Introduction of China State Construction Engineering Corporation[88]

Brief Introduction

China State Construction Engineering Corporation (CSCEC) was established in 1982. As a state-owned important and back-boned enterprise under the administration of the Central Government, CSCEC has operated actively in both domestic and overseas markets with construction and real estate business as its core business. Under the guidance of the reform and opening-up policy of the Party and government, with correct leadership of higher authority and warm assistance of all sectors of society, and through hard work of the leaders and staff for decades, CSCEC has become the largest construction enterprise and the largest international contractor in China. It has been listed as one of the world top 225 international contractors by ENR since 1984, ranking 16th in 2002. CSCEC has also been ranked the first for international economic cooperation among China's top 500 service enterprises since 1994. In the list of China's top 100 important enterprises in 2002, CSCEC was ranked 10th by annual sales and 12th by assets. From its foundation in 1982 to the end of June 2002, total contract value of CSCEC reached RMB 502.6 billion and its turnover arrived at RMB 434.7 billion, of which oversea contracts and oversea turnover accounted for 28% and 30% respectively. By the end of June 2002, CSCEC's total assets amounted to RMB 74.1 billion, far ahead among the enterprises in China's construction sector.

CSCEC has made great contribution to development of architectural science and technologies. CSCEC's integrated construction technique, applied in the construction of the testing facility for the vertical rocket assembly at the Shenzhou Space Center, which was one of the three major projects in the nation's eighth five-year plan, has won the First Prize for National Scientific & Technology Advancement. This was one of the three first prizes awarded to China's construction sector. CSCEC has also won 392 local and national awards for craftsmanship and building excellence for projects.

[88] Source: Adapted from http://www.cscec.com.cn/english/index.htm

Up to now, CSCEC is proud that over 66 projects completed have won the Lu Ban Award, the highest award in the construction sector in China.

CSCEC has enjoyed an international reputation for having completed a large number of remarkable projects over past few decades including landmark high-rising structures and array of what is best described as unique projects. CSCEC has been recognized as a well-known trademark in both domestic and international construction sectors. The Shenzhen International Trade Center and Sun Hing Square projects, received national recognition for CSCEC ability to achieve record delivery time frames through coordination and scheduling. The New Hong Kang Airport Passenger Terminal has been praised by authority organisations worldwide and called one of the top 10 building projects of the 20th century.

Confronting with new situations after China's entry into WTO, CSCEC now, with completely new ideas, scientific management and fine-quality services, strictly follows the development thought of commercialization, systematical operation and scientific management, focuses on sorting out the relationship between parent company and its subsidiaries, optimizes allocation of resources, and actively promotes the readjustment of the property rights and industrial structures of 5 key backbone enterprises and 12 traditional backbone enterprises including 8 engineering bureaus and 4 design institutes. In this way, CSCEC will strive to become one of top-ranking transnational enterprises in the world.

Organisational Structure of CSCEC

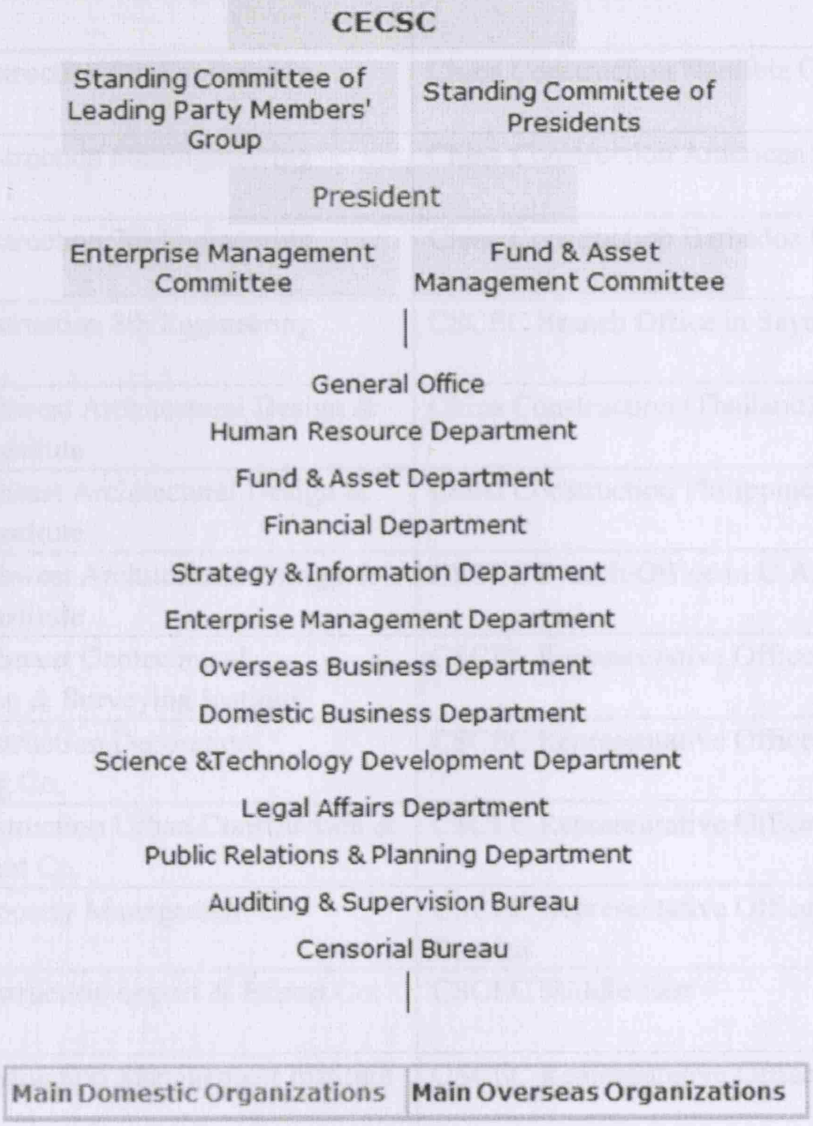


Figure A3. 1Organisational Structure of CSCEC

Main Domestic Organisations	Main Overseas Organisations
China State Construction International Co.	China Overseas Holding Ltd., (Hong Kang)
China Construction Development Co. Ltd.	China Overseas Holding Ltd., (Shenzhen)
China Construction First Building (Group) Corporation Ltd.	CSCEC Branch Office Algeria
China Construction 2nd Engineering Bureau	China Construction (South Pacific) Development Co. Pte. Ltd

China Construction 3rd Engineering Bureau	CSC & EC(PTY) Ltd.
China Construction 4th Engineering Bureau	China Construction Namibia Co. Ltd.
China Construction 5th Engineering Bureau	China Construction Namibia Co. Ltd.
China Construction 6th Engineering Bureau	China Construction American Co.
China Construction 7th Engineering Bureau	China Construction Barbados Co. Ltd.
China Construction 8th Engineering Bureau	CSCEC Branch Office in Seychelles
China Northwest Architectural Design & Research Institute	China Construction (Thailand) Co. Ltd.
China Northeast Architectural Design & Research Institute	China Construction Philippines Co. Ltd.
China Southwest Architectural Design & Research Institute	CSCEC Branch Office in U.A.E.
China Southwest Geotechnical Investigation & Surveying Institute	CSCEC Representative Office in Japan
China Construction Decoration Engineering Co.	CSCEC Representative Office in Korea
China Construction Urban Construction & Development Co.	CSCEC Representative Office in Ireland
CSCEC Property Management Co.	CSCEC Representative Office in Russian
China Construction Import & Export Co.	CSCEC Middle East
China Construction Management Institute	CSCEC Representative Office in Europe

Introduction of China Construction Eighth Engineering Division[89]

Brief Introduction

China Construction Eighth Engineering Division (abbreviated to CCEED), subordinate to China State Construction Engineering Corporation, is a large state-owned backbone construction enterprise. It was established in 1952.

As a member of the first group of experiment enterprises of China construction management comprehensive reform and one of the general contractors of class A state qualification, CCEED owns four building construction companies, one industrial installation company, one civil construction company, one mechanized construction company, and one decoration company totally eight subsidiaries with state class A construction qualification (note: All these eight subsidiaries have got ISO9000 quality system certificate). Besides eight subsidiaries, CCEED also has six branch companies, one design institute, one supervision company and one property development company. It has the capacity of a general contractor for the design, construction, scientific research, and material equipment supply of large industrial and civil buildings. In recent years, it has continuously ranked as one of top-10 good construction enterprises in China. CCEED owns 5.3 billion yuan RMB fixed assets, more than 2,600 sets of construction equipment, and 13,788 employees, of whom 268 employees are senior engineers, 1853 employees are engineers, and 4898 employees are technicians. The total annual construction value is more than 5 billion yuan RMB. CCEED can provide construction service for a great variety of professions, such as petrochemical, communication, electronic, traffic, automobile, building material, machinery, textile, pharmacy, military industries and space-flight, national defense works etc. Its business scope has spread to more than 20 provinces in China and further to southeast of Asia, middle east of Asia and north Africa.

With many years construction experiences, CCEED has formed several sets of construction process and management, especially in deep foundation protection, foundation treatment, large volume concrete construction, large re-bar concrete egg-shape building construction, fabrication and erection of steel structure, decoration,

[89] Source: Adapted from http://www.cscec8b.com.cn/english/index.htm

road and bridge construction, industrial equipment installation (including petrochemical equipment). CCEED kept good construction quality, and kept more than 65% excellent quality rate. 144 projects awarded provincial excellent prize, 19 projects awarded highest prize, "LuBan" Award in China, of which 16 projects are acted as main constructor, and 3 projects are acted as joint constructor. CCEED have been appraised as provincial "enterprise abiding by contracts and keeping promises" and the special-class (AAA) credit enterprise. CCEED is also "National safe construction enterprise" by Chinese Construction Ministry.

Skilled as a general contractor for housing and building, CCEED has made great achievements in the construction of "high, large, new type, special and key" projects. As core item for China manned space plan, the project of vertical general rocket assembly and testing plant in Jiuquan Satellite Base was awarded First Grade National Technique Advancement Prize for its general construction technology. The project of twin Dalian COSCO Towers is the first steel structure skyscrapers project constructed by a Chinese enterprise as general contractor. The terminal building of Guangzhou New Baiyun International Airport is presently the largest and highest level airport project in P.R.China. Taida International Hospital in Tianjin city is one of the most advanced hospital for the treatment if heart bloodvessel diseases in Asia. Shanghai Communication Trade Plaza is one of the most intelligent office buildings in China. Zhengzhou International Conference and Exhibition Center is one of the most advanced large exhibition centers in China in terms of functions and facilities. COSCO Liangwan City in Shanghai is one of the largest modern communities under construction in China. Shareton-club des Pins in Algeria is one of the most luxury five star hotels in North Africa and around Mediterranean. It is the eternal target of CCEED to construct higher, larger and typical high quality buildings.

Introduction of Shanghai Urban Construction Group[90]

Brief Introduction

Shanghai Urban Construction (Group) Corporation, established in October 1996 with the approval of Shanghai Municipal Party Committee and the Government, is a comprehensive enterprise particularly supported by the Ministry of Construction and Shanghai Municipal Government. It is authorized by Shanghai State-owned Asset Management Committee to manage the state-owned assets within the Group.

Shanghai Urban Construction (Group) Corporation has the special-class qualification for municipal public works, the first-class general contracting qualifications for highway construction, housing, etc.. Among its subsidiaries are 1 special-class and 9 first-class general contracting construction enterprises and 5 A-grade design institutes. This is a large-scale enterprise group with general contracting of construction projects as its chief business, real estate development and management as its important support, integrated with various engineering design, construction, management and materials supply.

The Group Corporation and its subsidiaries are the main force in municipal construction in Shanghai and constructed and partly constructed during last decade more than 150 key projects in Shanghai including elevated roads (Inner Ring Elevated Road, Outer Ring Elevated Road, South-North Elevated Road, Yan'an Elevated Road, etc.), metro and track traffic projects, sewerage treatment projects, trans-river tunnel projects (Dapu Rd Tunnel, Yan'an Rd Tunnel, the Pedestrian Tunnel), expressway projects (Shanghai-Jiading Expressway, Shanghai-Nanjing Expressway, Shanghai-Hangzhou Expressway, Shanghai-Qingpu-Pingwang Expressway, Tongjiang-Sanya National Highway, Outer Ring Road), Hongqiao Airport, Pudong Airport, Nanpu Bridge, Yangpu Bridge and Xupu Bridge, the comprehensive reconstruction of the Bund and the People's Square, etc., and is now undertaking construction of the largest immersed tunnel in Asia and the first two-storied tunnel in China --- Fuxing Rd Tunnel. Also they have built houses with a total floor space of more than 6 millions square meters. In these years the Group has actively participated

[90] Source: Adapted from http://www.sucgcn.com/english/index.php

in construction outside Shanghai, including Xiamen Airport, Baiyun Airport in Guangzhou, Changle Airport in Fuzhou, Hangzhou-Jinhua-Quzhou Expressway, Zhapu-Jiaxing-Suzhou Expressway, Jiaozuo-Xingzhuang Expressway, Ningbo Beilun Port Power Plant, Changhong Tunnel, Shanxi Wanjiazhai Yellow River Water Intake Project, Chongqing Egongyan Bridge, Haikou Century Bridge, Harbin Sun Bridge, metro projects in Guangzhou, Shenzhen and Nanjing, etc., and has been contracting for projects in Singapore, Hongkong, Thailand and so on.

Organisational Structure of SUCG

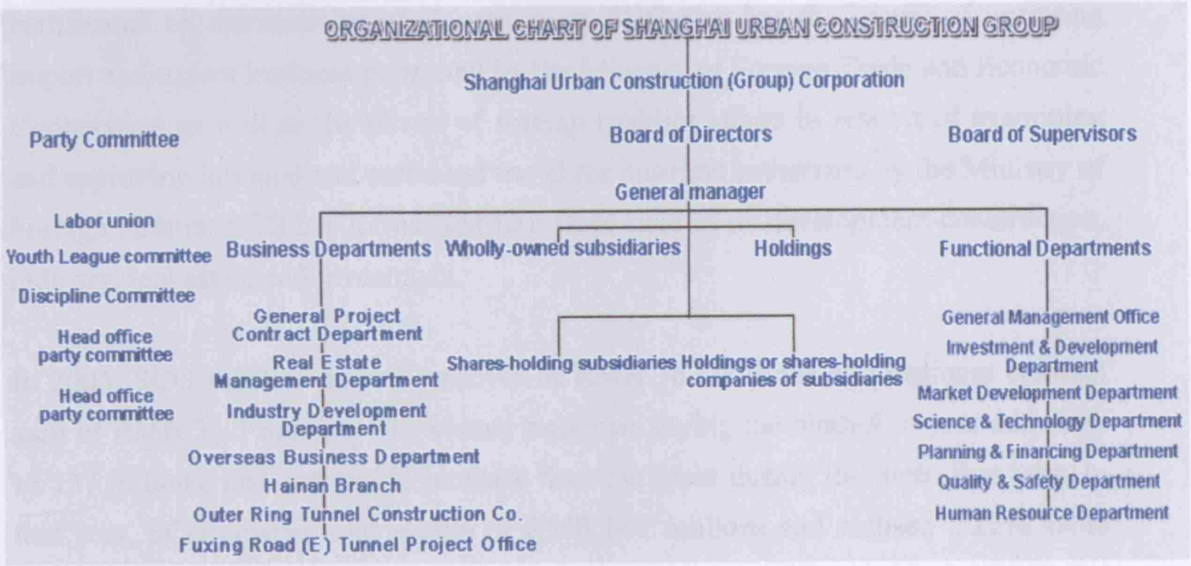


Figure A3. 2 Organisational Structure of SUCG

Introduction of Shanghai Construction Group[91]

Brief Introduction

Shanghai Construction Group (SCG) is a large group enterprise given major supports from the State Council and Shanghai Municipal Government, and with over 200 subordinates of sole proprietorship and holding companies or enterprises, possessing total assets of 29.437 billions and state owner's rights and interests of 5.233 billions, holding double-super qualifications both for building construction and municipal works-the highest national qualification as a general contractor confirmed and certificated by the ministry of Construction; SCG also has the power of operating import and export business permitted by the Ministry of Foreign Trade and Economic Cooperation as well as the power of foreign (public) affairs in respect of examining and approving inbound and outbound travel for business authorized by the Ministry of Foreign Affairs; SCG has formalised four large field of its development-construction, industry, real estate and investment.

In 2005, SCG fulfilled annual turnover of RMB 36.6 billions and business contract sum of RMB 35.6 billions. The annual turnovers during the tenth-five-year added up to 137 billions, and got 46.5% increase than the gross during the ninth five-year. In this year, SCG created total profits of RMB 607 millions and realised 8.22% value increment ratio of the State Assets.

[91] Source: Shanghai Construction (Group) General Co. 2005 Annual Report.

Organisational Structure of SCG

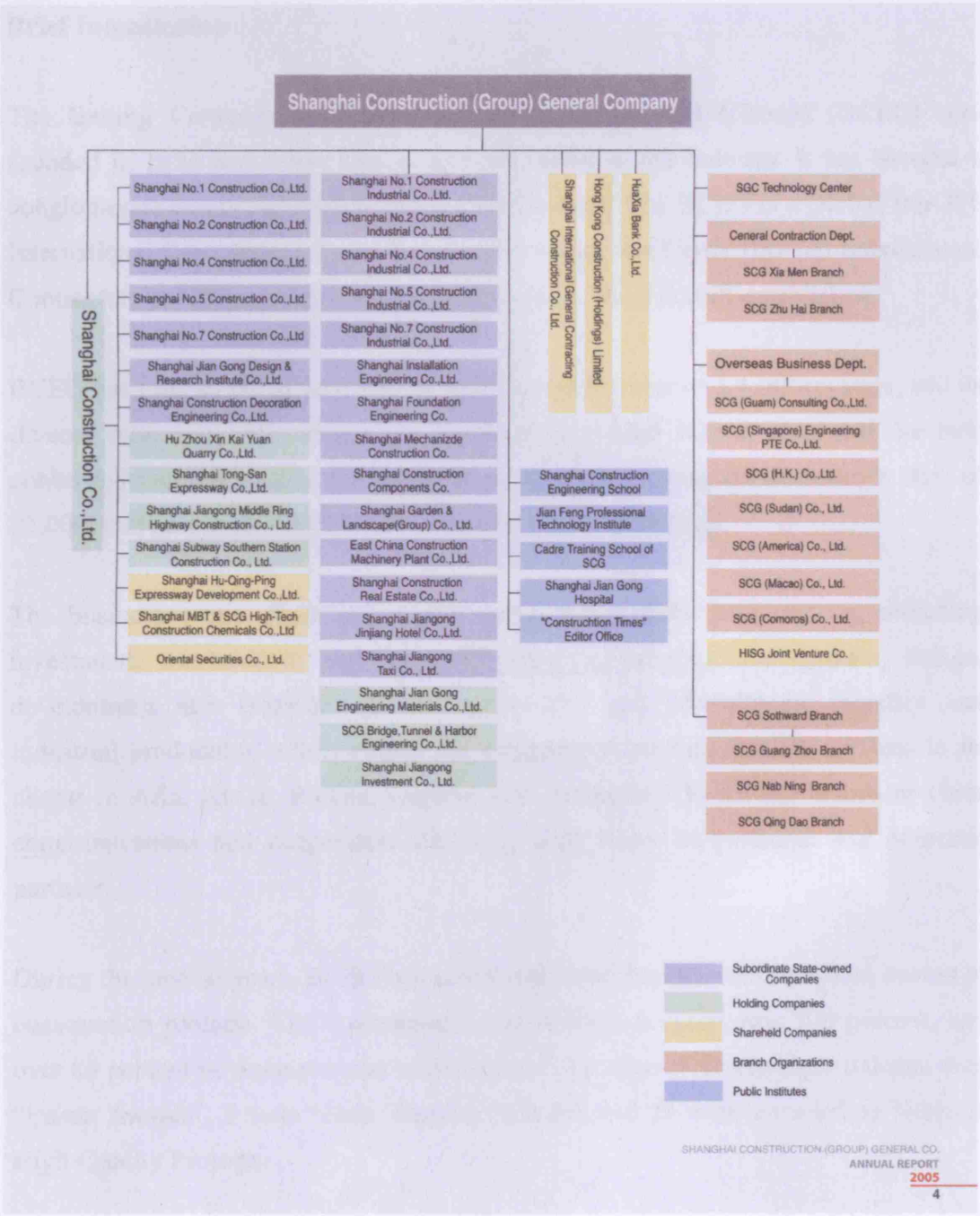


Figure A3. 3 Organisational Structure of SCG

Introduction of Beijing Construction Engineering Group[92]

Brief Introduction

The Beijing Construction Engineering Company Limited (Group) (BCEG) was founded in 1953 and it has been a constant leader in the industry. It has become a conglomerate that is competitive in the global market. The BCEG is a Global Top-225 International Contractor, a China Top-500 Enterprise and China Top-Ten International Contractor. Its "Beijing Construction Engineering" brand is well-established.

BCEG has total assets of 16.8 billion yuan, net-asset value of 3.4 billion yuan, and its diverse economic undertakings are worth at least 17.5 billion yuan and the new contracted volume reached 20 billion yuan in 2004. Among the company's staff of 23,000, there are 15,000 technicians and 600 senior technicians.

The business scope of BCEG ranges across many fields and regions, including investment, construction, real-estate development, property management, design, development and research; project supervision and consultancy, logistics and industrial production, which allows the company to provide turnkey services to its clients in Asia, Africa, Europe, Oceania and Americas. The Group maintains close communications and cooperates effectively with many international and domestic partners.

During the past 50 years, BCEG has completed more than 85 million square meters of construction projects. The qualification rate of these projects was 100 percent, and over 80 percent of these projects were deemed "excellent." Thirty-eight projects won "Luban Awards", 5 won "Zhan Tianyou Awards" and 20 were awarded as National High-Quality Projects.

[92] Source: Beijing Construction Engineering Co., LTD. (Group) 2005 Annual Report.

Organisation Diagram of BCEG[93]

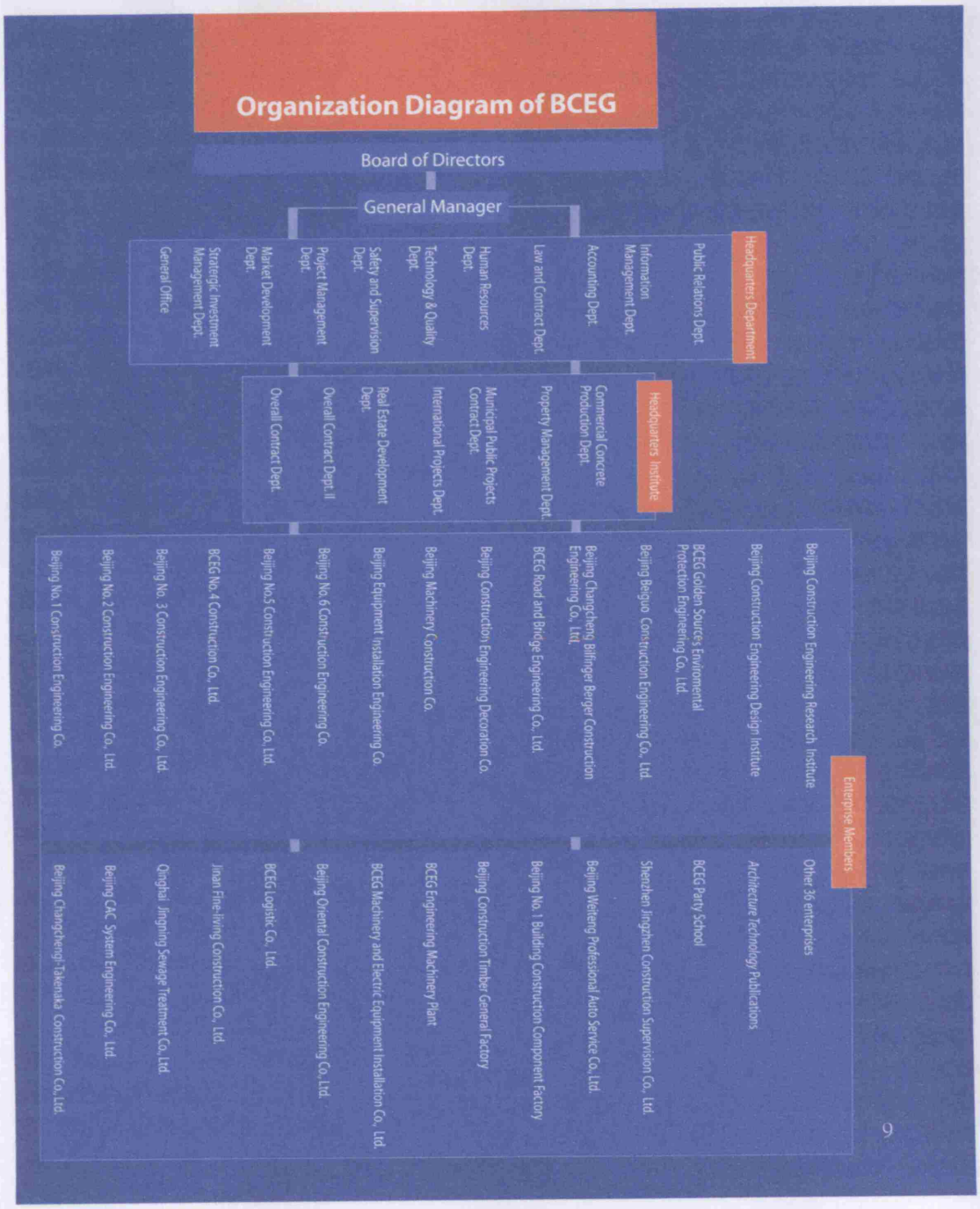


Figure A3. 4 Organisational Structure of BCEG

[93] Source: Adapted from http://www.bcegc.com/

Map of Business Coverage of BCEG[94]

部分国际合资伙伴：
Partners of International Cooperation Projects includes:

美国金州集团
American Golden State Group
德国贝尔芬格伯格建筑工程有限公司
Germen Bilfinger Berger Construction Engineering Co., Ltd.
日本竹中公务店
Japanese Takenaka Corporation
新加坡 MAE 集团
Singapore MAE Group
加拿大茵莱玻璃纤维有限公司
Canada Inline Fibreglass Co., Ltd.
加拿大普罗贝尔公司
Canada Pro-Bel Group

部分国际工程：
International Projects includes:

多哥总统府
Togo Presidential Palace
坦桑尼亚国家体育场
Tanzania National Stadium
刚果总统行宫
Congo Presidential Palace
几内亚广电中心
Guinea Broadcasting and TV Centre
中国驻赤道几内亚大使馆
China Embassy in Equatorial Guinea
中国驻印尼大使馆
China Embassy in Indonesia
马来西亚住宅，马来西亚槟城皇冠饭店
Malaysian Housing Project
Malaysian Penang Crown Hotel
哈萨克斯坦北京大厦
Kazakhstan Beijing Plaza
关岛住宅小区
Guam Housing Project
毛里求斯 1600 套住宅
Mauritius 1,600 Apartments Project
毛里求斯自由港办公楼
Mauritius Free Port Administration Building
博茨瓦纳金融大厦
Botswana Financial Plaza
泰国常青大厦
Thailand Evergreen View Tower
斯里兰卡班达拉奈克国会大厦
Sri Lanka Bandaranaike Congress Building
俄罗斯卡玛斯工厂
Russia Kamaz Factory
阿尔巴尼亚电视塔
Algeria TV Tower

Figure A3. 5Map of Business Coverage of BCEG

[94] Source: Beijing Construction Engineering Co., LTD. (Group) 2005 Annual Report.

Appendix 4

Construction Industry and Economic Development in China's Provinces

Table A4. 1 Provincial GDP values and descriptive statistics 1990–2000[95]

Provincial GDP values and descriptive statistics, 1990–2000 (in 100 million RMB yuan, current price)						
Eastern provinces	1990	1992	1994	1996	1998	2000
Beijing	500.82	709.1	1084.03	1615.73	2009.9	2478.76
Tianjin	310.95	411.24	725.14	1102.4	1340.7	1639.36
Hebei	836.14	1155.05	2187.49	3452.97	4238.1	5088.96
Liaoning	965.72	1297.65	2461.78	3157.69	3805.6	4669.06
Shanghai	744.67	1114.32	1971.92	2902.2	3688.2	4551.15
Jiangsu	1315.82	1971.6	4057.39	6004.21	7200.8	8582.73
Zhejiang	836.89	1220.69	2666.86	4146.06	4980	6036.34
Fujian	459.48	694.7	1658.34	2583.83	3330.2	3920.07
Shandong	1333.37	1982.02	3872.18	5960.42	7162.2	8542.44
Guangdong	1471.84	2293.54	4240.56	6519.14	7937.2	9662.23
Guangxizhuangzu	392.83	572.3	1241.83	1869.62	2181.9	2050.14
Hainan	95.01	141.68	330.95	389.53	438.9	518.48
Mean	771.96	1130.32	2208.21	3308.65	4026.14	4811.64
Standard deviation	440.36	673.95	1309.87	2008.31	2418.83	2949.44
Co. of variation	0.57	0.6	0.59	0.61	0.6	0.61
Central provinces	1990	1992	1994	1996	1998	2000
Shanxi	399.86	519.8	853.77	1308.01	1606.7	1643.81
Neimenggu	286.74	378.62	681.92	984.78	1192	1401.01
Jilin	393.97	514.58	936.78	1337.16	1564.4	1821.19
Heilongjiang	658.96	855.93	1618.63	2402.58	2830	3253
Anhui	606.53	730.19	1488.47	2339.25	2828.3	3038.24
Jiangxi	419.54	559.52	948.16	1517.26	1850.2	2003.07
Henan	895.74	1213.23	2224.43	3661.18	4339	5137.66
Hunan	702.64	920.13	1694.42	2647.16	3211.4	3691.88
Hubei	791.09	1001.37	1878.65	2970.2	3704.2	4276.32
Mean	572.79	743.71	1369.47	2129.73	2569.58	2918.46
Standard deviation	207.54	274	533.32	896.33	1079.22	1297.23
Co. of variation	0.36	0.37	0.39	0.42	0.42	0.44
Western provinces	1990	1992	1994	1996	1998	2000

[95] Source: Adapted from Ofori and Han (2003).

Sichuan	1144.88	1481.22	2777.88	2985.15	3580.3	4010.25
Guizhou	254.87	331.67	521.17	713.7	843.5	993.53
Yunnan	395.99	510.03	973.97	1491.62	1793.1	1955.09
Xizang	24.45	33.29	45.84	64.76	—	117.46
Shaanxi	374.05	492.64	816.58	1175.38	1410.5	1660.92
Chongqing	—	—	—	1179.09	1434.5	1589.34
Gansu	234.04	301.64	451.66	714.18	869.8	983.36
Ningxia	61.1	78.62	133.97	193.62	227.3	265.57
Qinghai	66.34	84.32	138.24	183.57	218.6	263.59
Xinjiangweiwu'erzu	251.88	382.26	673.68	912.15	1115	1364.36
Mean	311.96	410.63	725.89	961.32	1276.96	1320.35
Standard deviation	339.77	438.86	833.55	855.91	1013.42	1141.41
Co. of variation	1.09	1.07	1.15	0.89	0.79	0.86
Minimum	24.45	33.29	45.84	64.76	218.6	117.46
Maximum	1471.84	2293.54	4240.56	6519.14	7937.2	9662.23
Mean	574.21	798.43	1511.89	2209.18	2764.42	3135.79
Sum	17,226.21	23,952.95	45,356.69	68,484.60	82,932.50	97,209.37
Standard deviation	393.46	582.5	1148.73	1708.03	2044.76	2503.09
Co. of variation	0.69	0.73	0.76	0.77	0.74	0.8

According to Table A4.1, China's GDP as summed from provincial data increased progressively from 1723 billion RMB yuan in 1990 to 9721 billion RMB yuan in 2000. It shows that there were considerable differences among the provinces. The mean GDP for the eastern region was about 50% higher than that of the central region between 1990 and 2000, whereas the mean for the central region was nearly double that for the western region during the same period.

Table A4. 2 Provincial variations in construction VA 1991–2000[96]

Provincial variations in construction VA, 1991–2000 (in 100 million RMB yuan, current price)						
Eastern provinces	1991	1992	1994	1996	1998	2000
Beijing	35.94	52.94	94.73	141.73	176.8	198.19
Tianjin	16.85	20.61	42.81	57.36	71.9	72.89
Hebei	42.74	55.4	126.76	201.43	266.6	313.23
Liaoning	63.29	80.71	149.17	158.61	190	229.51
Shanghai	35.85	40.71	79.93	143.36	200.5	207.02
Jiangsu	68.09	101.32	184.55	319.32	466.5	587.37
Zhejiang	55.75	71.7	151.32	237.39	270	300.1

[96] Source: Adapted from Ofori and Han (2003).

Fujian	29.45	49.82	109.64	169.89	236	241.09
Shandong	82	109.52	200.15	310.65	404.3	507.02
Guangdong	102.6	192.51	376.41	480.53	520.2	573.72
Guangxizhuangzu	17.37	26.04	65.22	84.05	111.2	128.16
Hainan	9.79	17.68	40.82	34.49	34.9	36.69
Mean	46.64	68.25	135.13	194.9	245.74	282.92
Standard deviation	28.36	49.09	91.97	126.73	151.66	184.62
Co. of variation	0.61	0.72	0.68	0.65	0.62	0.65
Central provinces	1991	1992	1994	1996	1998	2000
Shanxi	25.47	29.85	50.64	70.93	117.1	121.2
Neimenggu	21.29	31.71	55.81	64.76	79.2	101.07
Jilin	21.31	29.84	44.13	71.83	94.7	144.6
Heilongjiang	43.82	53.1	88.7	120.95	176.2	204.2
Anhui	34.94	39.99	63.4	95.17	128.2	195.86
Jiangxi	18.95	31.26	69.07	105.47	126.9	160.98
Henan	51.83	64.1	113.74	193.02	268.2	334.84
Hunan	38.99	52.51	92.3	137.32	176.3	231.15
Hubei	32.36	42.02	79.31	125.89	173.7	220.42
Mean	32.11	41.6	73.01	109.48	148.94	190.48
Standard deviation	11.36	12.46	22.51	40.74	57.08	70.16
Co. of variation	0.35	0.3	0.31	0.37	0.38	0.37
Western provinces	1991	1992	1994	1996	1998	2000
Sichuan	79.96	104.12	216	325.93	254.7	306.65
Guizhou	13.04	15.67	22.87	32.82	56.3	73.12
Yunnan	17.24	25.13	47.78	77.56	130.9	145.55
Xizang	1.9	1.9	4.49	7.01	—	17.08
Shaanxi	28.5	34.05	58.12	79.83	124.2	182.32
Chongqing	—	—	—	—	107.2	130.03
Gansu	14.72	18.44	24.7	38.3	69.9	111.47
Ningxia	6.35	9.62	11.97	17.66	24.3	27.04
Qinghai	4.65	6.31	9.89	12.1	17.6	33.45
Xinjiangweiwu'erzu	23.92	41.35	74.91	97.43	138	164.76
Mean	21.14	28.51	52.3	76.52	102.57	119.15
Standard deviation	23.73	31.12	65.86	99.04	72.67	88.49
Co. of variation	1.12	1.09	1.26	1.29	0.71	0.74
Minimum	1.9	1.9	4.49	7.01	17.6	17.08
Maximum	102.6	192.51	376.41	480.53	520.2	587.37
Mean	34.63	48.33	91.64	133.76	173.75	203.25
Sum	1039	1449.9	2749.3	4012.8	5212.5	6300.8
Standard deviation	24.78	39.04	76.91	109.56	122.42	145.27
Co. of variation	0.72	0.81	0.84	0.82	0.7	0.71

Table A4. 3 Provincial variations in growth of construction value added 1991-2000 (%)[97]

Provincial variations in growth of construction value added, 1991–2000 (in %)					
Eastern provinces	91/92	92/94	94/96	96/98	98/2000
Beijing	47.3	33.77	22.32	11.69	5.88
Tianjin	22.31	44.12	15.75	11.96	0.69
Hebei	29.62	51.26	26.06	15.05	8.39
Liaoning	27.52	35.95	3.12	9.45	9.91
Shanghai	13.56	40.12	33.92	18.26	1.61
Jiangsu	48.8	34.96	31.54	20.87	12.21
Zhejiang	28.61	45.27	25.25	6.65	5.43
Fujian	69.17	48.35	24.48	17.86	1.07
Shandong	33.56	35.19	24.58	14.08	11.99
Guangdong	87.63	39.83	12.99	4.05	5.02
Guangxizhuangzu	49.91	58.26	13.52	15.02	7.36
Hainan	80.59	51.95	-8.08	0.59	2.53
Mean	44.88	43.25	18.79	12.13	6.01
Standard deviation	23.66	7.95	12.07	6.06	4.07
Co. of variation	0.53	0.18	0.64	0.5	0.68
Central provinces	91/92	92/94	94/96	96/98	98/2000
Shanxi	17.2	30.25	18.35	28.49	1.74
Neimenggu	48.94	32.67	7.72	10.59	12.97
Jilin	40.03	21.61	27.58	14.82	23.57
Heilongjiang	21.18	29.25	16.77	20.7	7.65
Anhui	14.45	25.91	22.52	16.06	23.6
Jiangxi	64.96	48.64	23.57	9.69	12.63
Henan	23.67	33.21	30.27	17.88	11.74
Hunan	34.68	32.58	21.97	13.31	14.5
Hubei	29.85	37.38	25.99	17.46	12.65
Mean	32.77	32.39	21.64	16.56	13.45
Standard deviation	16.42	7.6	6.72	5.69	6.91
Co. of variation	0.5	0.23	0.31	0.34	0.51
Western provinces	91/92	92/94	94/96	96/98	98/2000
Sichuan	30.22	44.03	22.84	□11.60	9.73
Guizhou	20.17	20.81	19.79	30.97	13.96
Yunnan	45.77	37.89	27.41	29.91	5.45
Xizang	—	53.73	24.95	—	—
Shaanxi	19.47	30.65	17.2	24.73	21.16
Chongqing	—	—	—	—	10.13

[97] Source: Adapted from Ofori and Han (2003).

Gansu	25.27	15.74	24.52	35.09	26.28
Ningxia	51.5	11.55	21.46	17.3	5.49
Qinghai	35.7	25.19	10.61	20.6	37.86
Xinjiangweiwu'erzu	72.87	34.6	14.05	19.01	9.27
Mean	37.62	30.46	20.31	20.75	15.48
Standard deviation	18.31	13.66	5.48	14.5	10.91
Co. of variation	0.49	0.45	0.27	0.7	0.71
Minimum	13.56	11.55	-8.08	□11.60	0.69
Maximum	87.63	58.26	33.92	35.09	37.86
Mean	39.12	36.16	20.1	15.88	11.08
Standard deviation	20.21	11.26	8.8	9.44	8.41
Co. of variation	0.52	0.31	0.44	0.59	0.76

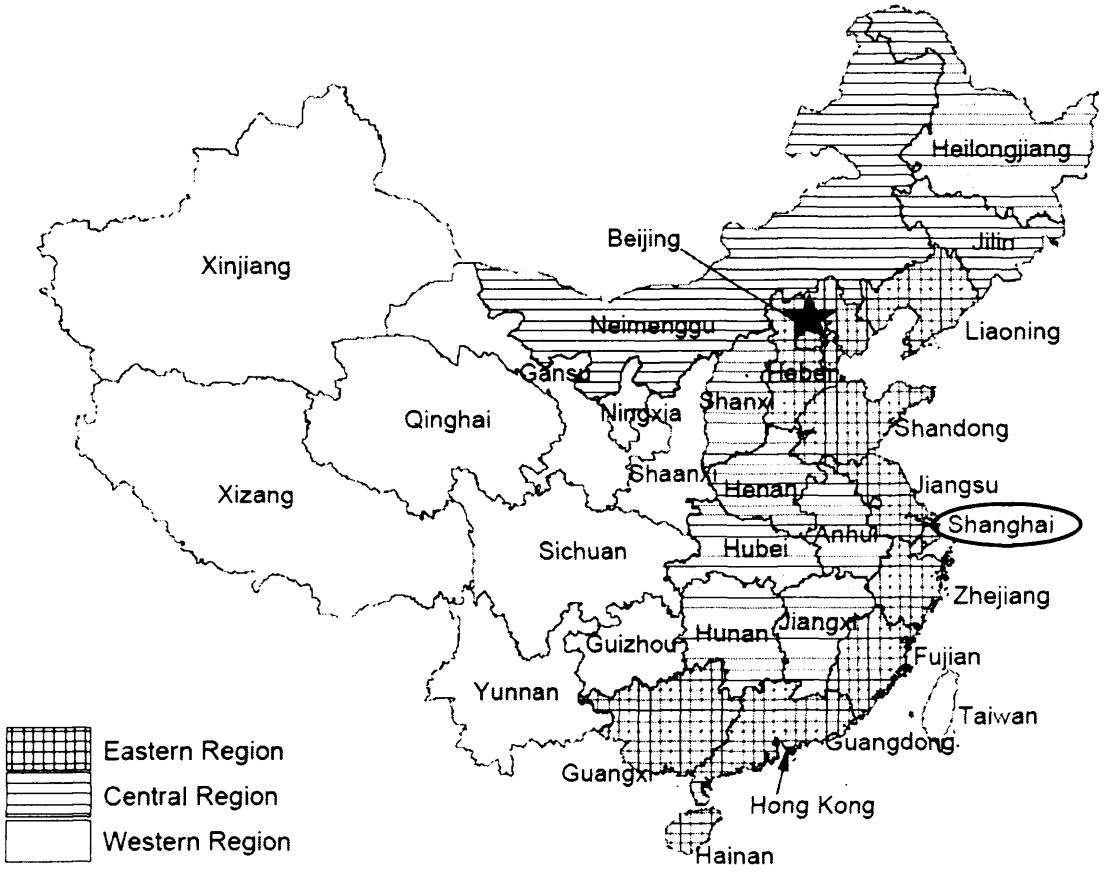


Figure A4. 1 China's provinces and the three regions[98]

[98] Source: Adapted from Ofori and Han (2003).

Appendix 5

Frameworks for Make-or-buy Decisions

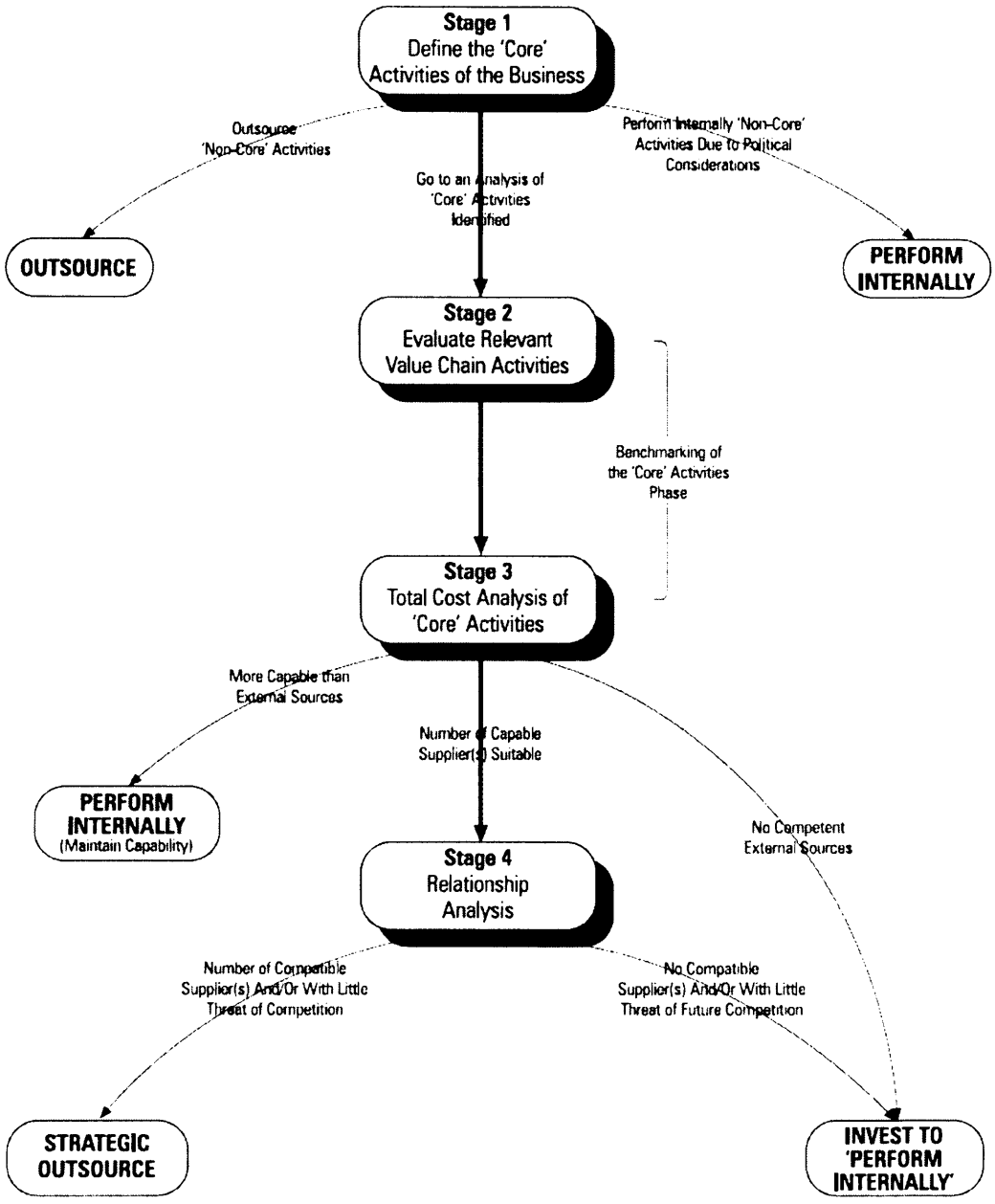


Figure A5. 1 A Practical Framework for Evaluating the Outsourcing Decision[99]

[99] Source: Adapted from McIvor (2000).

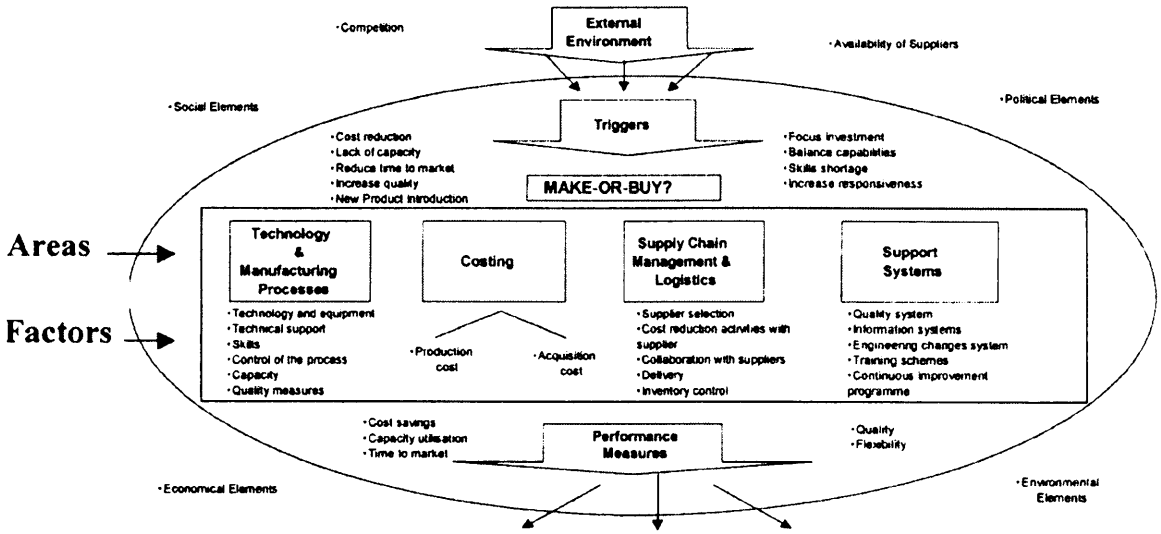


Figure A5. 2 A Framework for Make-or-buy Decisions[100]

[100] Source: Adapted from Platts et al. (2002).

Appendix 6

Terminology

The terminology used in subcontract is varied and often confused. The definitions set out below attempt to remove any ambiguity from this report and set out a common standard for subcontract terms.

Contract: A contract is an agreement that defines the conditions of exchange. Contracts may take standardized forms. Or they may be lengthy and complicated because they are carefully tailored to a specific transaction (Besanko, et al. 2004).

Information asymmetry: Information asymmetry means the probability that one party to the contract will have information that the other party does not have (Vining and Globerman, 1999)).

Outsourcing: An abbreviation for "outside resource using". Outside means creating value not within the own company. With this outside perspective, a company's border becomes more and more interesting. This outside focus does not end in itself. It means a strategic perspective on external resources. It is not enough to know about these external resources. They must be used by and for a company in order to reinforce its position in competition (Arnold, 2000).

The boundary of the firm: Defined by a transaction cost advantage that the firm enjoys through lower-cost internal integration and coordination over contracting the same goods and services in an exchange economy (Coase, 1937).

Transaction costs (TC): Transaction costs are the costs associated with conducting an economic exchange, such as search, selection, bargaining, monitoring and enforcement (Madhok, 2002).

Transaction cost analysis (TCA): TCA combines economic theory with management theory to determine the best type of relationship a firm should develop in the market place (Williamson, 1975).

Transaction cost economics (TCE): An interdisciplinary undertaking that joins economics with aspects of organisational theory and overlaps extensively with contract law (Williamson, 1979).

Value chain: The process that begins with the acquisition of raw materials and ends with the distribution and sale of finished goods (Besanko, et al. 2004).